NORTH CAROLINA
Turnpike Authority

Maintenance Rating Program

Triangle Expressway

2014 Fourth Quarter and Annual Report

1 S. Wilmington Street
Raleigh, NC 27601

Last Updated:
January 29, 2015

CONSULTANT CERTIFICATION OF COMPLETION

January 19, 2015

Mr. Andy Lelewski, PE
NCTA Director of Toll Road Operations
1 South Wilmington Street
Raleigh, NC 27601

NCTA Triangle Expressway Roadway and Facility Maintenance Performance Rating Program

This is to certify that I, Ken M. McEntire, PE am an authorized official representative of the company Asset Management Associates, PLLC, which is a subconsultant to HNTB North Carolina, P.C. Collaboratively, we are working as the Triangle Expressway Roadway and Facility Maintenance Performance Rating Program Consultants.

I know of my own personal knowledge, and do hereby certify, that the work of the contract described above has been independently performed in accordance with, and in conformity to, the *NCTA Roadway and Facility Maintenance Performance Standards, Version 4 September 2013*.

Sincerely,

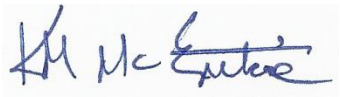

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Table of Contents

List of Figures

List of Tables

Appendices

1.0 EXECUTIVE SUMMARY

The North Carolina Turnpike Authority (NCTA) Maintenance Rating Program (MRP) is a maintenance evaluation program for roadway features and toll facilities on the NCTA system. This report presents results from the 2014 Fourth Quarter Assessment of the Triangle Expressway.

The overall 2014 fourth quarter maintenance rating of the Triangle Expressway is 86.8. This score represents the fourth consecutive quarter where our score is not above our overall Expressway target rating score of 90. As shown in **Table 1**, three of the five element rating scores are below the desired rating of 85; Drainage (82.5), Roadside (83.2), and Traffic Control Devices (82.1).

TABLE 1: MRP ELEMENT RESULTS FOR THE 2014 FOURTH QUARTER ASSESSMENT

ELEMENT	MRP Rating	Target Rating
Road Surface	93.3	85
Unpaved Shoulders	94.6	85
Drainage	82.5	85
Roadside	83.2	85
Traffic Control Devices	82.1	85
Overall MRP Performance Rating	**86.8**	**90**

This report also provides the results from the fourth quarter toll facility maintenance services verification process. During this quarter, all maintenance services met contract expectations with the exception of fire and carbon monoxide alarms and fire extinguishers services.

In addition, the report provides findings of the Green Level Historic District signs inspections. This quarter, all Green Level Historic District signs were found to be in good physical condition, and the landscaped areas around the signs were well maintained.

As part of the NCTA MRP, this report also provides a summary and analysis of the 2014 Annual Assessment of the Triangle Expressway. Four quarterly inspections were conducted throughout 2014 in February, May, August and November. The surveys, when totaled, produce the annual rating and are a statistically valid representation with a 95% confidence level in statistical sampling for the Triangle Expressway. The annual rating is a summation of the quarterly inspection results rather than a straight average of each quarter's individual rating to compensate for slightly uneven sample sizes.

The overall 2014 annual maintenance rating of the Triangle Expressway is 89.3. This score is slightly below our target rating score of 90 for the overall Expressway, and is 4.9 points lower than the 2013 annual maintenance rating. As shown in **Table 2**, all annual element ratings were above the desired

rating of 85. These annual results are a collective of the quarterly inspections conducted throughout the year. The recommended work plan adjustments should be scheduled in maintenance operations to improve these scores above the NCTA minimum threshold compliance. Further details are discussed in the Analysis and Recommendations section (pg. 9).

TABLE 2: 2014 ANNUAL MRP ELEMENT RESULTS

ELEMENT	Q1 RATING	Q2 RATING	Q3 RATING	Q4 RATING	2014 ANNUAL RATING
Road Surface	87.6	96.8	89.9	93.3	91.9
Unpaved Shoulders	91.5	87.6	92.9	94.6	91.6
Drainage	91.2	93.3	91.3	82.5	89.6
Roadside	94.6	84.7	87.6	83.2	87.5
Traffic Control Devices	94.4	86.1	85.0	82.1	86.9
Overall MRP Performance Rating	**91.9**	**89.8**	**88.6**	**86.8**	**89.3**

2.0 INTRODUCTION

The NCTA MRP is a comprehensive planning, measuring and managing process that provides a means for communicating to managers, stakeholders and customers the impacts of policy and budget decisions on program service delivery.

Using outcome based performance measures and the service level scale (0 through 100), the inspection results are rated against established thresholds criteria. The program analysis is accomplished through the use of sampling procedures that capture the level of service being provided for individual asset features. Over time, these ratings will be charted to identify work needs and subsequent necessary actions. The evaluations are based on the establishment of threshold conditions that quantify the maximum defect allowed to exist for a characteristic before it is considered unacceptable.

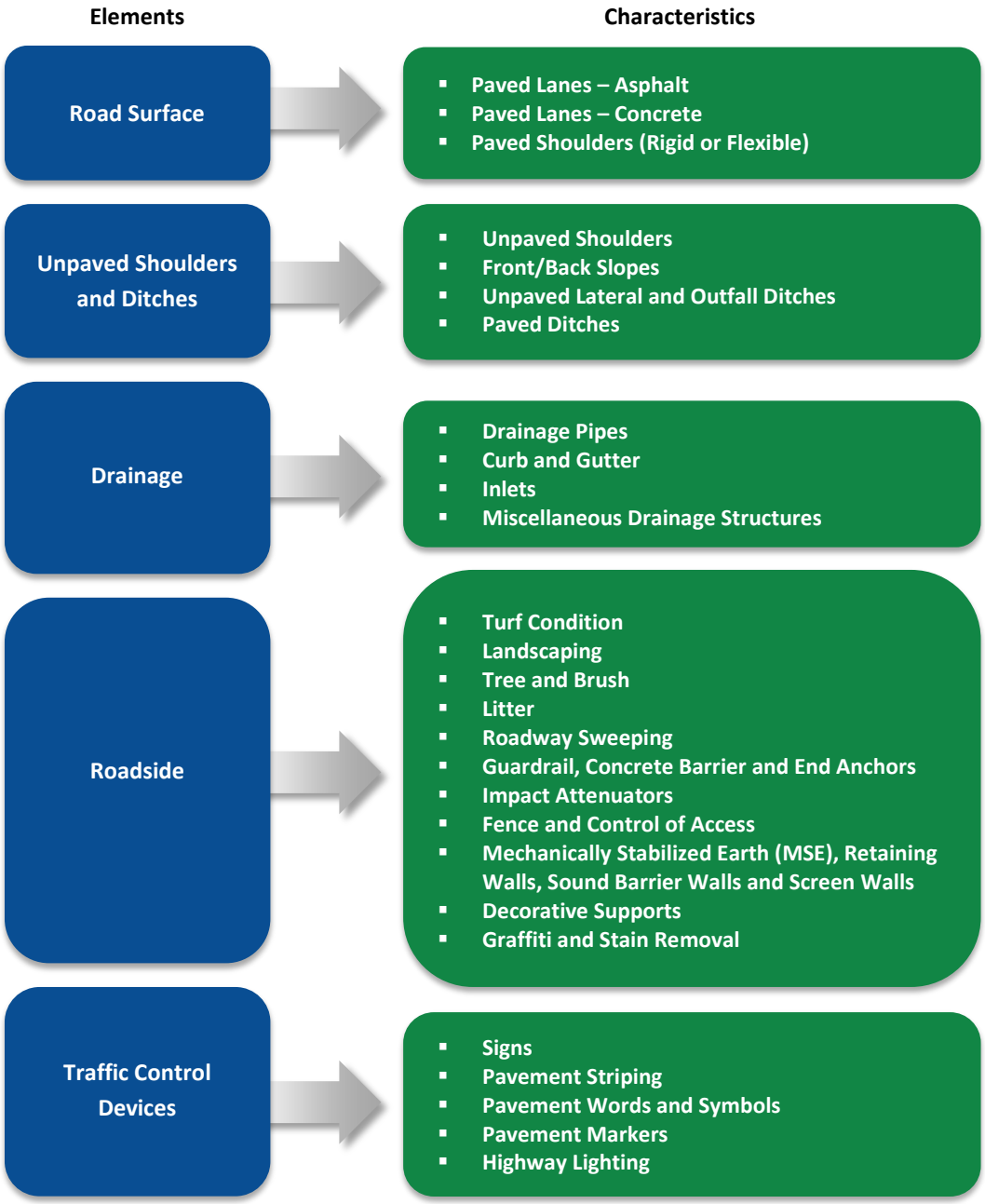
The NCTA performance standards, threshold criteria and maintenance rating program were developed through a collaborative effort by NCTA managers, NCDOT maintenance staff and consultants.

Using this field survey information, a maintenance matrix can be developed to show the ties between maintenance activities and the characteristics of various roadway features. The purpose of this evaluation is to provide information that will be used to schedule and prioritize routine maintenance activities and provide uniform maintenance conditions that meet established objectives.

3.0 MRP SURVEY PROCEDURE

Per the NCTA Roadway and Facility Maintenance Performance Standards, roadway assets on NCTA facilities have been grouped into characteristics which then roll up into 5 elements. These elements and their characteristics can be seen on the following page in ***Figure 1***:

Figure 1: Maintenance Elements and Characteristics



Due to some roadway characteristics being of greater importance than others, a weighted system is applied to enable rational calculation of an overall level of service rating. Although one set of weighting factors for all characteristics could serve this purpose, a more useful system consists of two sets of weighting factors: one set that accounts for the importance of individual characteristics within a given maintenance element (1-9) and another set that accounts for the importance of the maintenance elements to the total rating (by % of score). This two-set system reveals deficiencies among characteristics and it shows which maintenance elements are deficient.

The program analysis is accomplished through the use of statistically valid, random sampling procedures that capture the level of service for individual assets with a 95% confidence level in sampling. Inspections are performed during the months of February, May, August, and November to account for dynamic changes in assets during the various seasons. Each maintenance characteristic that is selected for sampling is evaluated according to the criteria developed by the NCTA performance standards. This evaluation is completed with the assistance of NCDOT's State Roadway Maintenance Unit using their electronic data collection tablets.

The evaluations are based on established threshold conditions that quantify the maximum defect allowed to exist for a characteristic before it is considered unacceptable. The ratings are done by comparing existing field conditions to the threshold value. If the characteristic meets or exceeds the threshold, then it is coded as PASSING. If it does not meet the criteria then it is coded as FAILING. When the survey is complete, the number of PASSING's and FAILING's are totaled, and a composite number (using a scale from 1 to 100) is produced. This number represents the level of maintenance currently being provided.

For any given asset, the number assigned as the target level of service represents the percentage of random samples in which the maintenance condition standard corresponding to the activity is to be met or exceeded. For instance, an activity with a level of service rating of 83 means that 83 percent of the sites met the condition standards.

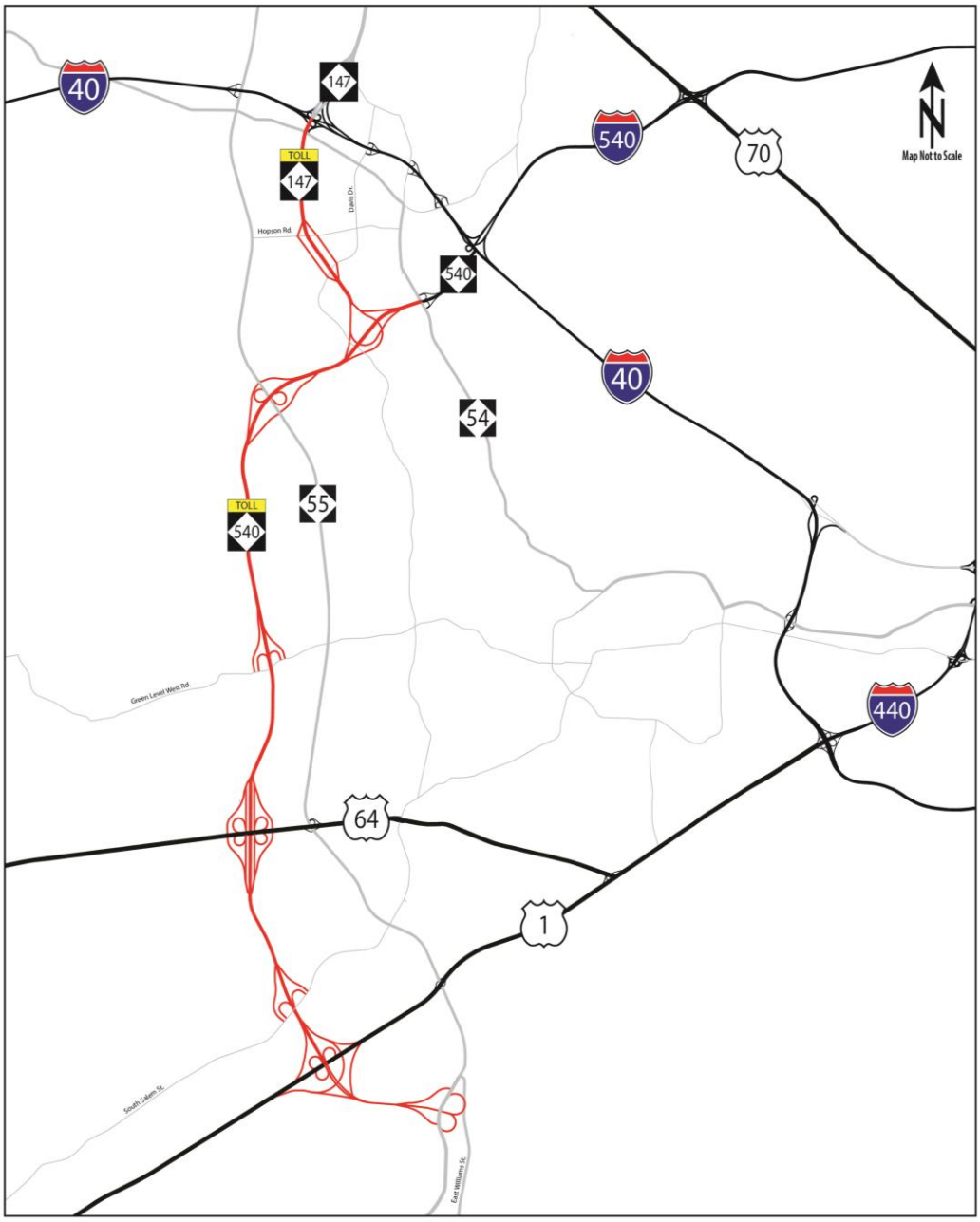
The annual rating is calculated from a summation of the quarterly inspections rather than taking the straight average of each quarter's rating. This is done to compensate for the event of uneven sample sizes for various assets to produce a more accurate result.

The NCTA's overall target rating score is 90, with each target element level scoring at or above 85 and every target characteristic at or above 80.

4.0 TRIANGLE EXPRESSWAY DESCRIPTION

The Triangle Expressway extends for approximately 18.8 miles from the interchange of I-40 and NC-147 on the north end to the NC-55 Bypass near Holly Springs, North Carolina on the south end (***Figure 2***). It includes approximately one mile segment on NC-540 extending north from the NC-540 / NC-147 interchange to the NC-54 interchange. The Triangle Expressway consists of ten interchanges and eighteen all-electronic toll collection zones.

Figure 2: Triangle Expressway Map



5.0 TRIANGLE EXPRESSWAY ASSET INVENTORY UPDATE

Through normal day to day maintenance activities and the construction of special projects, roadside assets are continuously being added and modified on the roadway. To ensure the validity of the MRP, there is necessary proactive actions to take that maintain an accurate asset inventory of the Triangle Expressway. These actions include coordination with NCDOT Division maintenance managers and routine field visits. As shown in **Table 3**, turf, plant beds and signs were the assets that experienced the largest inventory adjustments during the fourth quarter inventory update.

TABLE 3: INVENTORY UPDATE

ELEMENT	TOTAL POPULATION (UPDATED)	TOTAL POPULATION (ORIGINAL)
Barriers (BR)	552	552
Curb and Gutter (CG)	266	267
Decorative Supports (DS)	244	247
Drainage Pipes (DP)	1139	1140
Misc. Drainage Structures (MDP)	181	182
Fences (FN)	432	432
Highway Lighting (HL)	316	316
Impact Attenuators (IA)	39	40
Inlets (IN)	970	970
Plant Bed (PB)	293	282
Paved Ditches (PD)	2	2
Pavement Symbols (PS)	525	525
Signs (SN)	971	1000
Tree and Brush (TB)	570	571
Turf (TF)	1010	1017
Walls (WL)	113	112

6.0 MRP ASSESSMENT

6.1 Quarterly Results

The overall 2014 fourth quarter maintenance rating of the Triangle Expressway is 86.8. This score represents the third consecutive quarter where our score is below the NCTA overall Expressway target rating score of 90. Three of the five element rating scores are below the desired rating of 85, and many characteristics scored below the minimum rating of 80; Miscellaneous Drainage Structures (32), Turf Condition (46), Pavement Striping/Marking (68), and Pavement Markers (55). The fourth quarter results can be viewed in **Tables 4 and 5** of this report. It is important to note that these results are only representative of the fourth quarter sample, one of the four surveys done throughout the year to provide an intermediate snapshot of seasonal conditions. Therefore, they are not a statistically valid representation of the assets' conditions; only the total of all 4 quarter inspections at the end of each calendar year will provide a 95% confidence level in statistical sampling.

Appendix A shows maps of all the assets that were assessed during the fourth quarter. ***Appendix B*** shows a list of the individual assets that failed the MRP.

The MRP rating value designated to each element and feature refers to the percentage of elements or features that pass the asset's particular threshold criteria respectively. After developing an inventory and totaling each particular feature, they are assessed based on the established threshold criteria. The sample passed and sample totals are then multiplied by weighted values, which were assigned to each element based on importance. This determines the actual and available rating points. Lastly, an MRP Performance Rating is calculated for each asset and element group based on the ratio of the actual points over the available points. The MRP Performance characteristic rating results for the 2014 fourth quarter assessments are found in **Table 4*:***

TABLE 4: 2014 Q4 MRP CHARACTERISTIC RESULTS						
ROAD SURFACE	**SAMPLE PASSED**	**SAMPLE TOTAL**	**WEIGHTED VALUES**	**ACTUAL PTS**	**AVAILABLE PTS**	**2014 Q4 MRP RATING**
Paved Lanes Asphalt	14	14	9	126	126	100
Paved Lanes Concrete	16	17	9	144	153	94
Paved Shoulder	27	31	5	135	155	87
Element Total				**405**	**434**	**93.3**
UNPAVED SHOULDERS AND DITCHES	**SAMPLE PASSED**	**SAMPLE TOTAL**	**WEIGHTED VALUES**	**ACTUAL PTS**	**AVAILABLE PTS**	**2014 Q4 MRP RATING**
Unpaved Shoulder	29	31	9	261	279	94
Front/Back Slopes	30	31	6	180	186	97
Lateral and Outfall Ditches, Unpaved	29	31	6	174	186	94
Ditches, Paved	2	2	5	10	10	100
Element Total				**625**	**661**	**94.6**
DRAINAGE	**SAMPLE PASSED**	**SAMPLE TOTAL**	**WEIGHTED VALUES**	**ACTUAL PTS**	**AVAILABLE PTS**	**2014 Q4 MRP RATING**
Drainage Pipes	33	34	7	231	238	97
Curb and Gutter	21	25	6	126	150	84
Inlets	30	34	7	210	238	88
Misc. Drainage Structure	8	25	4	32	100	32
Element Total				**599**	**726**	**82.5**
ROADSIDE	**SAMPLE PASSED**	**SAMPLE TOTAL**	**WEIGHTED VALUES**	**ACTUAL PTS**	**AVAILABLE PTS**	**2014 Q4 MRP RATING**
Turf Condition	28	61	7	196	427	46
Landscaping	21	26	4	84	104	81
Trees and Brush	31	31	4	124	124	100
Litter	31	31	4	124	124	100
Roadway Sweeping	25	31	5	125	155	81
Guardrail, Concrete Barrier and End Anchors	31	31	9	279	279	100
Impact Attenuators	9	9	9	81	81	100
Fence, Control Access	28	29	7	196	203	97
Retaining Walls and Sound Barrier Walls	15	17	5	75	85	88
Decorative Supports	24	25	5	120	125	96
Graffiti and Stain Removal	30	31	4	120	124	97
Element Total				**1524**	**1831**	**83.2**
TRAFFIC CONTROL DEVICES	**SAMPLE PASSED**	**SAMPLE TOTAL**	**WEIGHTED VALUES**	**ACTUAL PTS**	**AVAILABLE PTS**	**2014 Q4 MRP RATING**
Signs	60	64	7	420	448	94
Pavement Striping	21	31	8	168	248	68
Words and Symbols	29	30	7	203	210	97
Pavement Markers	17	31	9	153	279	55
Highway Lighting	31	32	6	186	192	97
Element Total				**1130**	**1377**	**82.1**

The overall score is determined by summing the elements multiplied by weighted factors as follows: Road Surface (25%), Unpaved Shoulders (13%), Drainage (15%), Roadside (17%), and Traffic Control Devices (30%).

The overall MRP Performance element rating results for the fourth quarter is shown below in **Table 5*:***

TABLE 5: MRP ELEMENT RESULTS FOR Q4 2014

ELEMENT	Q4 2014 MRP Rating
Road Surface	93.3
Unpaved Shoulders	94.6
Drainage	82.5
Roadside	83.2
Traffic Control Devices	82.1
Overall MRP Performance Rating	**86.8**

6.2 Analysis and Recommendations

Elements

Three of the five elements fell below the NCTA minimum threshold criteria of 85 for the fourth quarter inspections. Drainage scored an 82.5, Roadside scored an 83.2, and Traffic Control Devices scored an 82.1.

Characteristics

Most characteristics satisfied the NCTA minimum threshold criteria of 80 with the exception of Miscellaneous Drainage Structures, Turf Condition, Pavement Striping/Markings, and Pavement Markers. This section focuses on the characteristics that need specific attention and future emphasis in the work plan in order to maintain the desired performance level. Additional information and pictures of each failure is included in ***Appendix B*** of this report.

Miscellaneous Drainage (32 rating – 17 of the 25 assets failed). Out of the 17 miscellaneous drainages that failed, 12 failed because of obstruction and 5 failed because of erosion. In order to avoid affecting the natural flow of water near the drainage features, it is recommended for the erosion problems noted to be fixed as soon as possible. It is also recommended that the maintenance provider plan to routinely clean these drainage features to remove any debris that may have been washed into the structure or grown up around it.

Figure 3: Miscellaneous Drainage Failures

Turf Condition (46 rating – 33 of the 61 assets failed). All 33 turf areas failed because of bare ground. Two (2) of the failing turf area can be seen in the figure below. Many of the bare ground areas previously had active Bermuda and Centipede runners growing that are now dead. It is suspected this was caused by low cutting heights during extreme heat months. With such a noticeable drop over the last few assessments in the turf condition it is recommended that the maintenance provider schedule overseeding of these areas with warm season grasses and possibly add soil enrichment to increase the chances of survival. It is further suggested that mowing heights continue to be closely monitored especially during the months of extreme heat conditions.

Figure 4: Turf Failures

Pavement Markers (55 rating – 14 of the 31 assets failed). Out of the 14 linear segments that failed due to pavement markers, 8 did not pass the night time inspection due to lack of markers' reflectivity and 7 of the 14 failed because of missing markers. **Figure 5** shows two examples of the missing markers failures found along the facility.

The Triangle Expressway saw several rounds of frozen precipitation this past winter where plows removed the non-snowplowable markers from bridge decks. It is recommended for the maintenance provider to consider replacing bridge deck markers as soon as practical at the end of each winter season. With attentive effort towards specific minor deficiencies the overall MRP score can be maintained cost effectively above the 90 percentile threshold.

Figure 5: Pavement Markers Failures

Pavement Striping (68 rating – 10 of the 31 assets failed). All 10 of the linear segments that failed due to pavement striping did not pass the night time inspection due to lack of reflectivity.

The lifespan of epoxy paint pavement markings are 3 to 5 years, as indicated by the rating some sections of the Triangle Expressway are approaching this time period. Preparations should be made in the budget and work schedule to plan for this work.

7.0 ANNUAL 2014 MRP RESULTS

The overall annual maintenance rating of the Triangle Expressway is 89.3. This score is below our target rating score of 90 for the overall Expressway, and is 4.9 points lower than last year's annual survey results. All element ratings were above the desired rating of 85. Paved Ditches (50), Miscellaneous Drainage Structures (69), Turf Condition (61) and Pavement Markers (68) are the four characteristics that scored below the minimum characteristic rating of 80. A summarized table of the 2014 quarterly and annual results can be viewed in **Tables 6 and 7** of this report. Work plan adjustments should be scheduled in maintenance operations to improve these scores above the minimum threshold compliance.

The MRP rating value designated to each element and feature refers to the percentage of elements or features that pass the asset's particular threshold criteria respectively. After developing an inventory and totaling each particular feature, they are assessed based on the established threshold criteria. The sample passed and sample totals are then multiplied by weighted values, which were assigned to each element based on importance. This determines the actual and available rating points. Lastly, an MRP Performance Rating is calculated for each asset and element group based on the ratio of the actual points over the available points. A summary of the MRP Performance characteristic rating results for the 2014 assessments are found in **Table 6*:***

TABLE 6: 2014 ANNUAL MRP CHARACTERISTIC RESULTS						
ROAD SURFACE	**SAMPLE PASSED**	**SAMPLE TOTAL**	**WEIGHTED VALUES**	**ACTUAL PTS**	**AVAILABLE PTS**	**2014 ANNUAL MRP RATING**
Paved Lanes Asphalt	53	56	9	477	504	95
Paved Lanes Concrete	67	68	9	603	612	99
Paved Shoulder	103	124	5	515	620	83
Element Total				**1595**	**1736**	**91.9**
UNPAVED SHOULDERS AND DITCHES	**SAMPLE PASSED**	**SAMPLE TOTAL**	**WEIGHTED VALUES**	**ACTUAL PTS**	**AVAILABLE PTS**	**2014 ANNUAL MRP RATING**
Unpaved Shoulder	111	124	9	999	1116	90
Front/Back Slopes	115	124	6	690	744	93
Lateral and Outfall Ditches, Unpaved	119	124	6	714	744	96
Ditches, Paved	4	8	5	20	40	50
Element Total				**2423**	**2644**	**91.6**
DRAINAGE	**SAMPLE PASSED**	**SAMPLE TOTAL**	**WEIGHTED VALUES**	**ACTUAL PTS**	**AVAILABLE PTS**	**2014 ANNUAL MRP RATING**
Drainage Pipes	130	136	7	910	952	96
Curb and Gutter	90	100	6	540	600	90
Inlets	125	136	7	875	952	92
Misc. Drainage Structure	69	100	4	276	400	69
Element Total				**2601**	**2904**	**89.6**
ROADSIDE	**SAMPLE PASSED**	**SAMPLE TOTAL**	**WEIGHTED VALUES**	**ACTUAL PTS**	**AVAILABLE PTS**	**2014 ANNUAL MRP RATING**
Turf Condition	148	244	7	1036	1708	61
Landscaping	89	104	4	356	416	86
Trees and Brush	124	124	4	496	496	100
Litter	124	124	4	496	496	100
Roadway Sweeping	118	124	5	590	620	95
Guardrail, Concrete Barrier and End Anchors	121	124	9	1089	1116	98
Impact Attenuators	34	36	9	306	324	94
Fence, Control Access	109	116	7	763	812	94
Retaining Walls and Sound Barrier Walls	60	68	5	300	340	88
Decorative Supports	98	100	5	490	500	98
Graffiti and Stain Removal	122	124	4	488	496	98
Element Total				**6410**	**7324**	**87.5**
TRAFFIC CONTROL DEVICES	**SAMPLE PASSED**	**SAMPLE TOTAL**	**WEIGHTED VALUES**	**ACTUAL PTS**	**AVAILABLE PTS**	**2014 ANNUAL MRP RATING**
Signs	232	256	7	1624	1792	91
Pavement Striping/Marking	109	124	8	872	992	88
Words and Symbols	117	120	7	819	840	98
Pavement Markers	84	124	9	756	1116	68
Highway Lighting	119	128	6	714	768	93
Element Total				**4785**	**5508**	**86.9**

A summary of the rolling MRP element results is found in **Table 7**:

TABLE 7: 2014 ANNUAL MRP ELEMENT RESULTS

ELEMENT	Q1 RATING	Q2 RATING	Q3 RATING	Q4 RATING	2014 ANNUAL RATING
Road Surface	87.6	96.8	89.9	93.3	91.9
Unpaved Shoulders	91.5	87.6	92.9	94.6	91.6
Drainage	91.2	93.3	91.3	82.5	89.6
Roadside	94.6	84.7	87.6	83.2	87.5
Traffic Control Devices	94.4	86.1	85.0	82.1	86.9
Overall MRP Performance Rating	**91.9**	**89.8**	**88.6**	**86.8**	**89.3**

8.0 TRIANGLE EXPRESSWAY TOLL FACILITY MAINTENANCE

As part of the Roadside Toll Collection System contract, XEROX is to provide toll facility maintenance for all Toll Zones along the Triangle Expressway. Facility maintenance will include all labor, equipment, materials and incidentals for the maintenance items under contract.

The equipment and services covered by the facilities maintenance agreement include:

- Air Conditioning Equipment
- Electrical Components
- Fire and Carbon Monoxide Alarms and Fire Extinguishers
- Standby Generators
- Security Components
- Toll Facility Vaults
- Pressure Cleaning
- Pest Control
- Grounding and Ground System Testing

Upon completion of any and all services performed on the equipment identified above, XEROX will create a Maintenance Log File with the following detailed information:

- Date of Service Request
- Date of Service Completion
- Date of Regularly Scheduled Maintenance Activities
- Detail of Tasks Performed
- List of Any Issues Found
- List of Any Replacement Parts Required
- Notification to NCTA for Replacement Part Approval

All maintenance logs will be stored in the CMMS (Computerized Maintenance Management System) database and submitted to NCTA through Constructware for review. As part of each quarterly inspection, HNTB will review the facility maintenance logs submitted to identify any problems reported during the services provided and ensure XEROX is meeting maintenance contract expectations. Equipment services will meet maintenance contract expectations only if the maintenance logs provided prove that the service has been completed.

8.1 Quarterly Results

Air Conditioning Unit Service Requirements	Status
Monthly Service (Scheduled for October, November and December 2014)	
• Replace filters (pleated high efficiency filters shall be used)	Completed
Semi-Annual Service (Scheduled for November 2014)	
• Perform inspection and maintenance checks/cleaning (preventative maintenance) on all air conditioning equipment units. All items in the preventive maintenance inspection shall be checked along with any other item necessary to ensure that each unit is operating properly. ○ Clean condenser and evaporator coils on air conditioning units, with industry approved chemicals and methods and per recommendations by the manufacturer. ○ Clean oil air handling units of the air conditioning equipment (per manufacture recommendations) ○ Clean drain pans and condensate lines of the air conditioning equipment. ○ Lubricate all motors required for the air conditioning equipment. ○ Clean inlet and outlet registers for the air conditioning equipment. ○ Check controls and thermostats for proper operation for the air conditioning equipment. ○ Check for leaks and adjust amounts of refrigerant as needed for the air conditioning equipment. ○ Record refrigerant pressures for the air conditioning equipment. ○ Check electrical connections for the air conditioning equipment. ○ Check for vibrations and noises stemming from the air conditioning equipment. ○ Check all belts and belt pulleys and replace worn belts for the air conditioning equipment.	Completed

Electrical Components Service Requirements	Status
Monthly Service (Scheduled for October, November and December 2014)	
• Electrical Distribution Equipment o Inspect electrical distribution equipment for warning signs, wear, or malfunction. o Inspect enclosures in electrical distribution equipment for damage, unauthorized openings, and corrosion of metallic objects. Repair and paint to match as required. Inspect air passages and remove any blockage. o Inspect, investigate, and solve conditions in which the electrical distribution equipment produces unusual odors. o As electrical distribution equipment is operated and tested, listen, investigate, and mitigate conditions for unusual noises. o Inspect electrical distribution equipment grounding components such as conductors and connections. Inspect insulators for damage. o Inspect liquid immersed electrical distribution equipment for leaks and damage. o Inspect indicating lights on electrical distribution equipment for correct illumination. o Remove debris, dirt, insect nests, and other foreign objects from all components, housings, cabinets, panels, etc. of the electrical distribution equipment. o Verify operation of space heaters and control thermostat of electrical distribution equipment. Check thermostat set point for proper setting.	Completed
Annual Service (Scheduled for November 2014)	
• Electrical Distribution System o Inspect electrical connections in the electrical distribution system for degradation. o Torque all electrical connections in the electrical distribution system to design value. o Verify the grounding of the equipment and associated neutral where applicable for the electrical distribution system. o Conduct infrared test on all main current carrying equipment in the electrical distribution system for hot spots that may indicate overheat conditions or loose connections. o Using calibrated test instruments, calibrate ammeters, voltmeters, etc. Verify continuity of metering selector switch contacts with ohmmeter. o Change filters on Main Distribution Panel in the electrical distribution system at site 6-1 and 7-2. o Inspect electronic power meter on Main Distribution Panels in the electrical distribution system for proper operation. • Low Voltage Panel Boards o Inspect electrical insulation of low voltage panel boards for discoloration and degradation. o Service low voltage panel board circuit breakers per manufacturers' recommendations. o Inspect low voltage panel board breakers' current carrying components for discoloration that may indicate overheating. o Perform insulation resistance test on each phase-to-phase and phase-to-ground for the low voltage panel boards using a megohmmeter.	Completed

Electrical Components Service Requirements	Status
Annual Service (Scheduled for November 2014)	
○ Prove low voltage panel board circuit breaker operation by actuation of each associated protective device. ○ Verify low voltage panel board Surge Protection Device (SPD) is functioning (lights). ○ Measure and record neutral currents for low voltage panel boards. • Automatic Transfer Switches ○ Inspect, operate, adjust, and lubricate mechanical linkages for the automatic transfer switches. ○ Verify operation of mechanical interlocks of automatic transfer switches. ○ Inspect and dress current carrying contacts in accordance with manufacturer's recommendations for the automatic transfer switches. ○ Test automatic transfer switches. Perform insulation resistance test on each phase-to-phase and phase-to-ground using a megohmmeter. ○ Perform contact resistance test for automatic transfer switches. ○ Prove correct operation of the transfer switches by manually initiating transfers in both directions. ○ Simulate the automatic conditions requiring automatic transfer switches to transfer in both directions. ○ Verify generator start on transfer for automatic transfer switches. ○ Verify correct indicating light operation for automatic transfer switches. ○ Verify equipment alarms – critical monitoring system for automatic transfer switches. • Safety Switches (Disconnects) ○ Inspect, operate, adjust, and lubricate mechanical linkages for safety switches. ○ Verify operation of mechanical interlocks for safety switches. ○ Inspect and dress current carrying contacts for safety switches in accordance with manufacturer's recommendations. ○ Test safety switches. Perform insulation resistance test on each phase-to-phase and phase-to-ground using a megohmmeter on each critical load switch. ○ Perform contact resistance test on each critical load switch.	Completed

Fire and Carbon Monoxide Alarms and Fire Extinguishers Service Requirements	**Status**
Monthly Service (Scheduled for October, November and December 2014)	
• Test smoke detector per manufacture's specification. • Test carbon monoxide detector per manufacture's specification. • Visual inspection of all for fire and carbon monoxide alarms and fire extinguishers. • Clean smoke detectors using a vacuum cleaner attachment to remove dust and cobwebs. If possible, carefully vacuum inside the unit as well. • Clean carbon monoxide detectors using a vacuum cleaner attachment to remove dust and cobwebs. If possible, carefully vacuum inside the unit as well. Retest test/silence button after each cleaning.	Completed
Annual Service (Scheduled for November 2014)	
• Fire and carbon monoxide alarm detector maintenance check. • Check charge on fire extinguisher. • Replace batteries for fire and carbon monoxide alarms.	Not Completed
Every Two (2) Year Service (Phases I & II Scheduled for September 2014, Phase III Scheduled for January 2015)	
• Replace carbon monoxide detectors.	N/A
Every Five (5) Year Service (Phases I & II Scheduled for August 2017, Phase III Scheduled for January 2018)	
• Re-fill and conduct a hydrostatic test on fire extinguishers.	N/A

Standby Generators Service Requirements	**Status**
Weekly Service	
• Exercise cycle run for standby generators for twenty (20) minutes. • Visual inspection of standby generators for obvious issues. • Verify the exercise cycle for standby generators has run.	Completed
Monthly Service (Scheduled for October, November and December 2014)	
• Visual inspection of all devices for standby generators. • Perform standby generator inspections. • Check all standby generator systems for leaks. • Engine o Test low oil pressure (LOP) safety – record seconds to shut down. o Test high engine temperature (HET) safety – record seconds to shut down. o Test over speed (O/S) safety – record seconds to shut down. o Check pre-alarms if applicable. o Check over crank (O/C) item – record seconds to shut down. o Check cycle cranker time. o Check noises or leaks. • Oil System o Check oil filter and gaskets. • Cooling system o Check general condition. o Sample and test anti-freeze and add if needed. o Check coolant level. o Pressure test system. o Check and replace belts and hoses if needed. • Exhaust System o Visually check for leaks, corrosion and check condensation trap and muffler condition. o Drain condensation if possible. • Fuel System o Check for leaks; check all visible connections and flexible hoses. Replace flexible hoses if needed. o Adjust carburetor as needed. o Service air filters as needed. o Clear debris from around engine from grass or other foreign sources. o Check tanks to ensure they meet EPA requirements for standby generators. o Keep monthly log of fuel tank inspect reports. • Generators o Visually inspect generator condition, check slip rings and commutator for wear, check lubrication of rear generator bearing. o Check diode heat sinks. • Battery o Check specific gravity and load test. o Check water level. o Clean terminals and posts and coat with inhibitor. o Check battery charge. o Replace all batteries at the end of the contract. • Ignition System o Check all wires. o Inspect plugs and electronic ignition. o Lubricate upper and lower bearing. o Set timing as needed.	Completed

Standby Generators Service Requirements	**Status**
Monthly Service (Scheduled for October, November and December 2014)	
• Accessories o Lubricate all hinges, door locks and cover snaps. Test locks and replace or repair as needed. o Inspect annunciator. o Inspect battery charger. o Adjust battery charger – AMP-MA o Adjust annunciator battery lights. o Inspect tanks for rust and corrosion; prepare and paint all areas showing signs of rust or corrosion. o Prepare and paint any areas on the generator enclosure showing signs of rust or corrosion.	Completed
Quarterly Service (Scheduled for November 2014)	
• Testing o Check unit under actual or full load as approved by the NCTA. This check should be performed after hours or during weekends. o Adjust voltage and frequency under actual load. o Adjust clock exerciser, day, time, load, no load. o Test delay start, pick up, transfer, cool down, transition and preheat. o Calibrate Under Voltage (UV) sensors, generator sensor, and Over Voltage (OV) sensors. o Record load per leg, voltage, hertz, oil pressure, and water temperature. o Check battery charging system. o Test transfer switch relays for proper operation including loss of single phase power. o Provide certification of proper operation. o Load test the Generator as recommended by the equipment manufacturer. o Annual 2 hour Load Bank test per manufacturer recommendation. o Provide load test reports. o Visually check for leaks.	Completed
Annual Service (Scheduled for November 2014)	
• Annual 2 hour Load Bank test per manufacturer recommendation. o Provide load test reports. o Visually check for leaks. • Replace batteries. • Replace filters annually.	Completed

Security Components Service Requirements	Status
Quarterly Service (Scheduled for December 2014)	
• Check all locks on security components are in working order. • Lubricate all security component locks per manufacturer's recommendations. • Verify keys for all security component locks can be located. • Note and report any lock tampering.	Completed

Toll Facility Vaults Service Requirements	Status
Weekly Service	
• Clear and remove all debris, litter, etc. inside toll facility vaults and out. • Remove cobwebs and insect nests from walls, corners and ceilings of all toll facility vaults. • Clean exterior door jambs, frames and transoms in all entrances.	Completed
Quarterly Service (Scheduled for October 2014)	
• Inspect the toll facility vaults for cracks in panels at sharp angles near doors and openings and at panel connection joints. • Inspect coatings for peeling on doors where concrete was cracking. • Inspect the floor coatings for chipping and wear. • Inspect for rust stains found around cracks, or exposed reinforcing steel, or other causes for concern. • Look at door and vault seals, caulking, exposed backer bar, or door jamb seals missing or damaged.	Completed
Annual Service (Scheduled for October 2014)	
• Inspection by and report on condition from a qualified structural engineer.	Completed

Pressure Cleaning Service Requirements	Status
Semi-Annual Service (Scheduled December 2014)	
• Provide all labor, materials, tools, equipment and incidentals (including water if not available at the facility) necessary to perform the work as specified. Use cleaners, degreasing agents and other approved means to remove all dirt, oil, tar, exhaust residue, spider webs and egg sacs, mud dauber nests, wasp and bee nests and any other deposit or film which may be present on the exterior of the vaults. Streaking of surfaces will not be allowed and manual scrubbing may be required in order to attain the desired results. • Materials Safety Data Sheets (MSDS) for all chemicals used shall be submitted by ACS. All chemical agents and additives must be approved by NCTA prior to beginning any work. • Protect all NCTA equipment during the time that cleaning is in progress. ACS shall be responsible for any and all damages caused by their Contractor's operations to either NCTA property or to the public moving through the facilities. No equipment, vehicles or materials may be stored at any NCTA facility. • Upon completion of each day's work, ACS shall ensure that the toll zone or facility being cleaned is free from debris caused by the work and remove and dispose of such debris off NCTA right-of-way. • The cleaning equipment shall be independently powered and capable of attaining adequate pressure and temperature to perform a job that meets the desired cleaning results. The equipment must also be designed to apply approved cleaning agents to surfaces to be cleaned in a volume sufficient to attain the desired cleaning results. Chemical cleaners that are used on surfaces in areas of plants and grass shall not be harmful to vegetation. Care shall also be taken to avoid any damage to existing grass, plants, shrubs and trees by equipment or personnel. Any plants or foliage damaged shall be replaced with equal or better plantings at no cost to the NCTA.	Completed

Pest Control Service Requirements	Status
Quarterly Service (Scheduled for November 2014)	
• Insect control includes those measures which are necessary to suppress general household insects within and around the facilities by using properly registered and labeled pesticide products and approved devices. • Rodent control includes those measures necessary to suppress populations of rats and mice that become a nuisance within or around the NCTA premises and equipment. There shall be no signs of infestations. • The program for the control of general pests shall be continually in effect. There shall be no signs of infestations. • Treat all areas of the facility to eliminate those pests mentioned above. These areas include, but are not limited to, vaults (interior and exterior perimeter which extends for a distance of fifteen feet (15') around the vaults), toll cabinets, emergency generators, and storage facilities. • Protect NCTA equipment during the time the work is underway. All materials for pest control shall conform to federal, state and local ordinances and precautions shall be used to avoid accident or injury to the employees and prevent damage to the facilities.	Completed

8.2 Analysis and Recommendations

As part of the fourth quarter assessment, HNTB reviewed all maintenance logs provided by XEROX for the months of October, November and December. According to these logs, air conditioning unit, electrical components, standby generators, security components, toll facility vaults, pressure cleaning, and pest control services were completed and are therefore meeting all maintenance contract expectations.

However, fire and carbon monoxide alarms and fire extinguishers services were only partially completed. No maintenance logs were submitted as proof of completion of the fire and carbon monoxide alarms and fire extinguishers annual service. Due to the lack of documentation proving that all scheduled services were completed, fire and carbon monoxide alarms and fire extinguishers services failed to meet maintenance contract expectations.

Problems were reported during the toll facility vaults third quarter and annual services. While no major structural problems were found, all vaults were reported to have cracks in the wall panel, roof panel, floor, or sidewalk. Out of the thirteen (13) vaults inspected, two (2) were reported to have water leakage during the third quarter service and five (5) were found to have the same problem during the annual service. In an effort to avoid structural failures in the future, the problems reported are being closely monitored.

Also, problems were reported during the September and December standby generator services. During the September standby generators monthly service, three (3) units were reported to have problems. In unit 3-2 the AST lock was found broken, in unit 7-2 a damaged wire was found and the heater in unit 8-1 was not working at the time of the inspection. In addition, during the standby generator weekly check of the month of December unit 7-1 failed to exercise, indicating low battery. As of January 2015, all standby generator problems reported have been repaired.

9.0 GREEN LEVEL HISTORIC DISTRICT SIGNS

The four (4) Green Level Historic District signs and surrounding landscaped areas were installed as part of the Triangle Expressway construction projects. Currently NCDOT is maintaining the Green Level Historic District signs and the Town of Cary is providing maintenance to the landscaped areas surrounding these signs.

9.1 Analysis and Recommendations

As part of each quarterly inspection, assessors visit the four Green Level Historic District signs to conduct a visual inspection of each sign to ensure they are in good standing. During the quarterly inspection, all signs were found to be in good condition, with the landscaped areas being well maintained. ***Figure 6*** shows two of these signs.

Figure 6: Green Level West Historic District Signs

10.0 CONCLUSION

This report represents the 2014 fourth quarter and the 2014 annual rating assessment of the Triangle Expressway. **The NCTA's target rating for an overall score is 90, the element level should not be below an 85, and no feature/characteristic should be below an 80.**

The 2014 fourth quarter score is **86.8** and the 2014 annual rating score is **89.3.** Both scores are down by several points; 1.8 points (88.6) from Q3 and 4.9 points (94.2) down from the 2013 annual, and are below the target rating score of 90.

Pavement markers should be checked and reapplied after the inclement weather season and prior to the start of the next season. Turf Condition is failing for both the quarter and for the annual rating score, and needs the most attention. It is recommended that over seeding of these areas occur with warm season turf seed such as Bermuda grass, and that the cycles of mowing and trimming are maintained with special attention toward preventing scalping the turf from low cutting heights.

Additionally, it should be noted that the Pavement Striping has scored a 68 for the 2014 Fourth Quarter and 88 for the 2014 annual rolling rating. The lifespan of epoxy paint pavement markings are 3 to 5 years and some of the Triangle Expressway is approaching this time period. Preparations should be made in the budget and work schedule to plan for this work.

This quarter almost all toll facility maintenance services met contract expectations. Due to lack of documentation proving that the scheduled maintenance services were completed, fire and carbon monoxide alarms and fire extinguishers services failed to meet contract expectations. Although some improvements have been observed, XEROX still needs to improve the development process of maintenance logs. Also, it is recommended that XEROX follows closely the maintenance logs' scheduled due dates to allow for NCTA to receive the required logs in a timely manner.

All Green Level Historic District signs inspected during the fourth quarter were found to be in good condition. Also, the landscaped areas surrounding the signs are being well maintained; improving sign visibility and aesthetic appearance.

Overall, the Triangle Expressway is being maintained well and in a manner consistent with other toll facilities in the United States.

Appendix A

Triangle Expressway 2014 Fourth Quarter Asset Assessment Locations

Appendix A: Triangle Expressway 2014 Fourth Quarter Asset Assessment Locations

Provided below are a series of maps outlining the assets that were a part of this quarter's sample and their corresponding result. Assets are defined by an Inventory ID, which is a unique identifier given to each individual asset. The components that make up the Inventory ID are an asset specific prefix along with a number, such as LS_1. All assets and their respective prefixes are listed below:

- Guardrail, Concrete Barrier and End Anchors – BR
- Curb and Gutter – CG
- Decorative Supports – DS
- Drainage Pipes – DP
- Misc. Drainage Structures – MDP
- Fence and Control of Access – FN
- Graffiti - GF
- Highway Lighting – HL
- Impact Attenutators – IA
- Inlets – IN
- Landscaping – PB
- Linear Samples – LS
    - Paved Lanes – Asphalt
    - Paved Lanes – Concrete
    - Paved Shoulders
    - Unpaved Shoulders
    - Front/Back Slopes
    - Unpaved Lateral and Outfall Ditches
    - Litter
    - Roadway Sweeping
    - Pavement Striping
    - Pavement Markers
- Paved Ditches – PD
- Pavement Words and Symbols – PS
- Signs – SN
- Tree and Brush – TB
- Turf Condition – TF
- MSE/Retaining Walls, Sound Barrier Walls, and Screen Walls – WL

Appendix A: Triangle Expressway 2014 Fourth Quarter Asset Assessment Locations

Legend

Passing Asset

Failing Asset

NORTH CAROLINA Turnpike Authority

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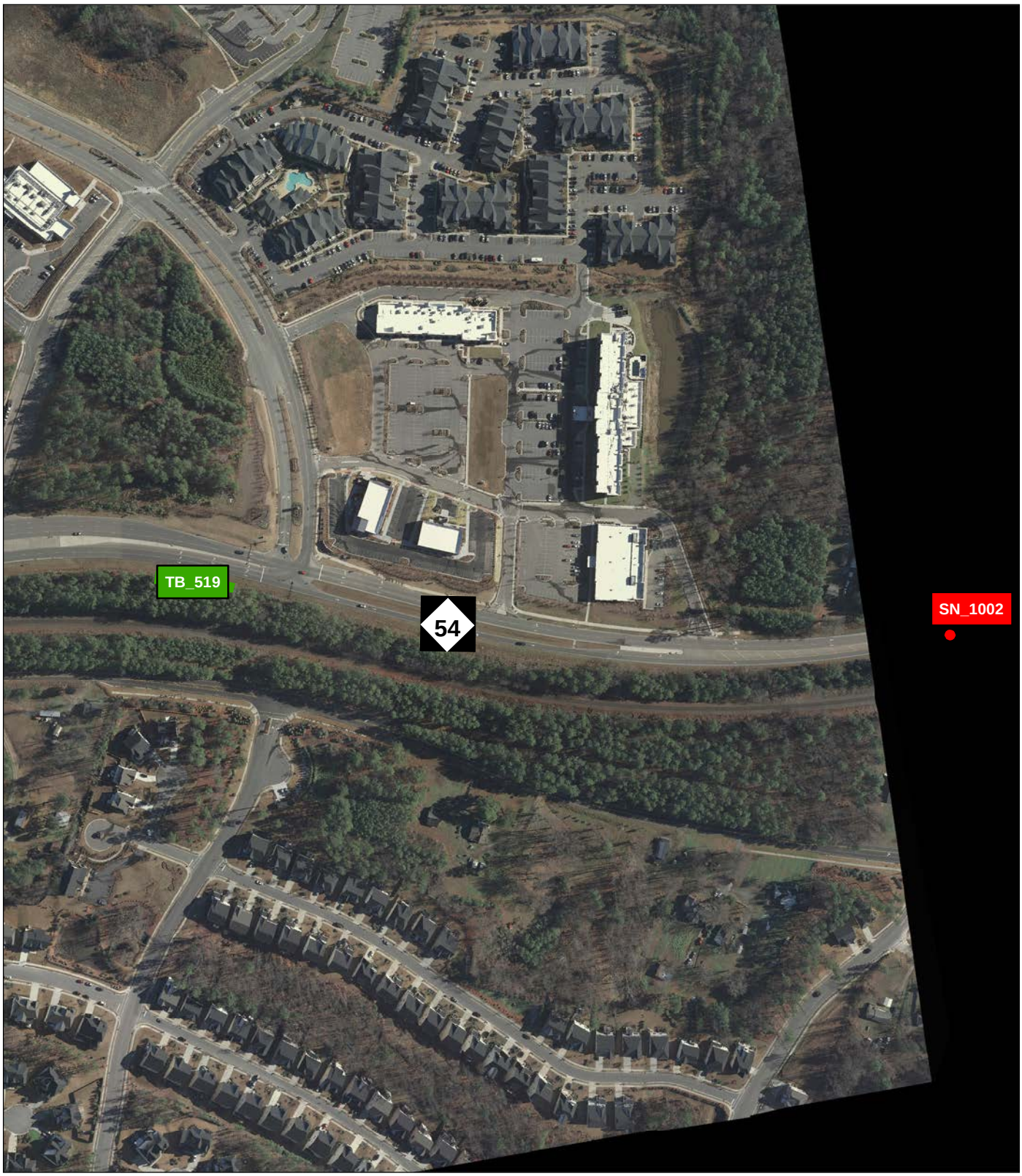

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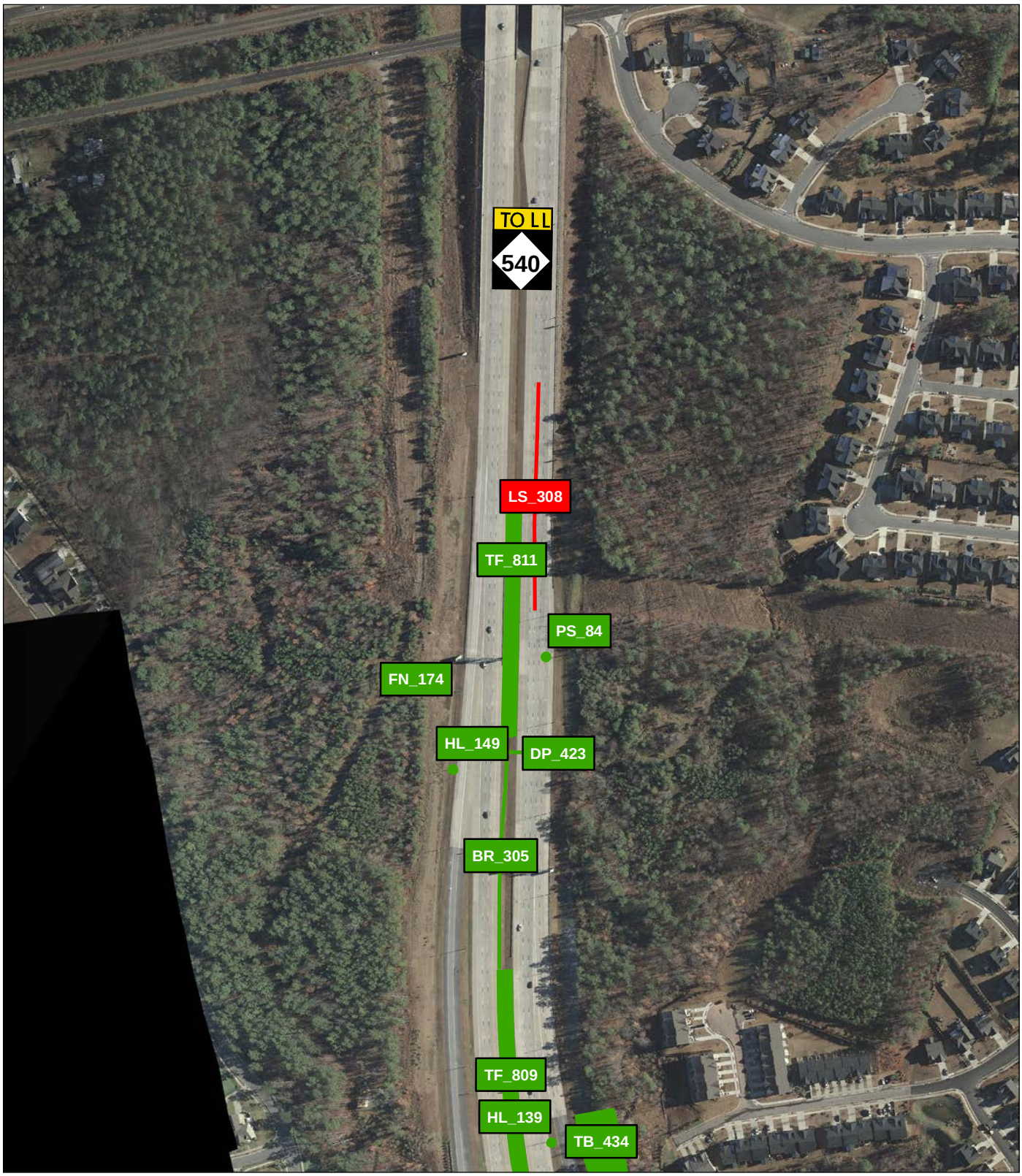
Appendix A: Triangle Expressway 2014 Fourth Quarter Asset Assessment Locations



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- Passing Asset
- Failing Asset

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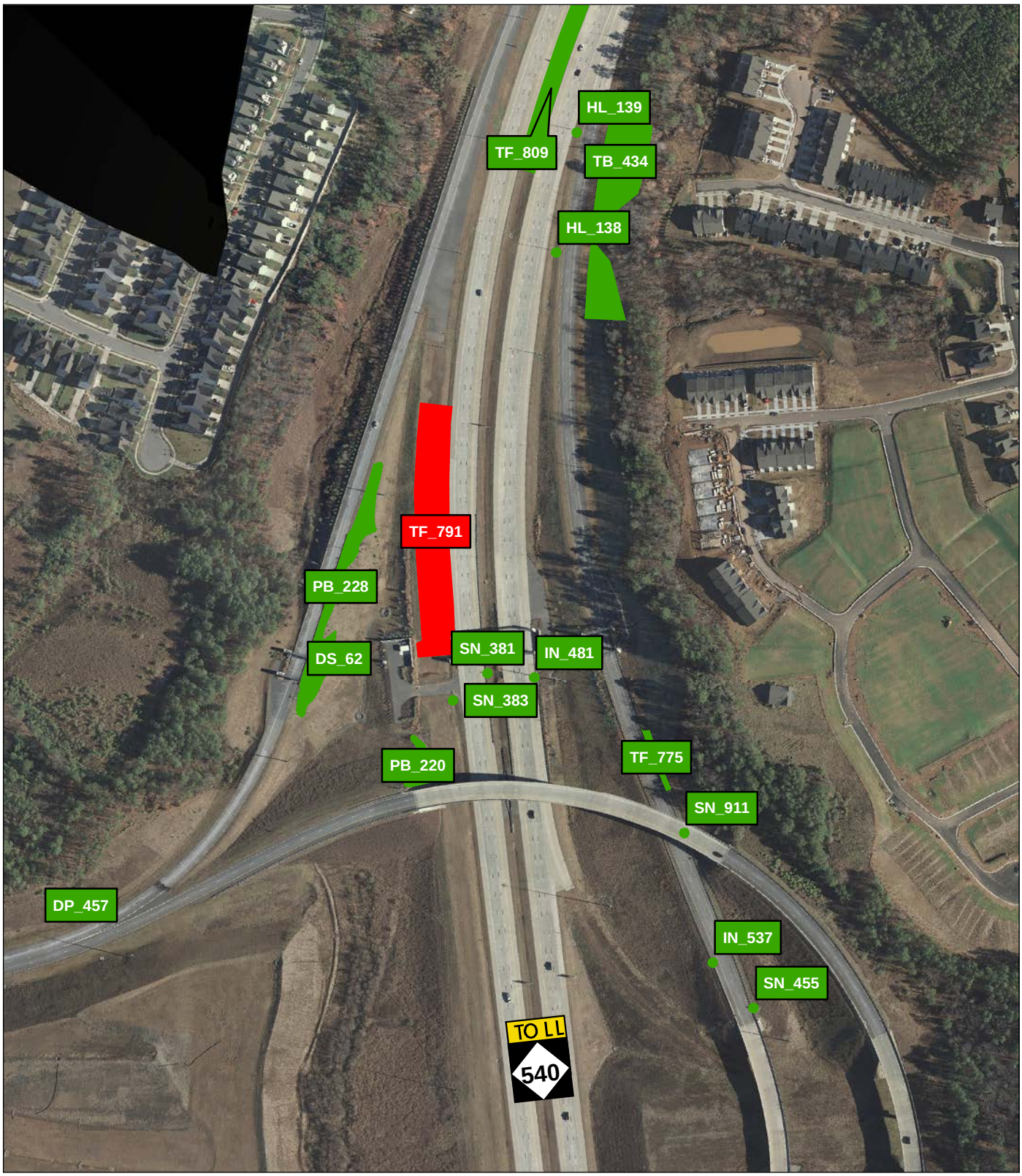

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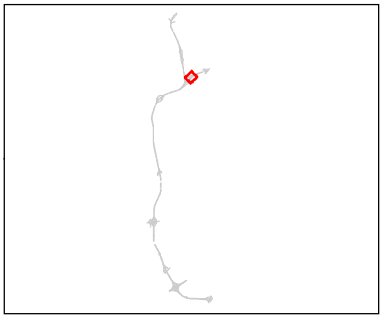

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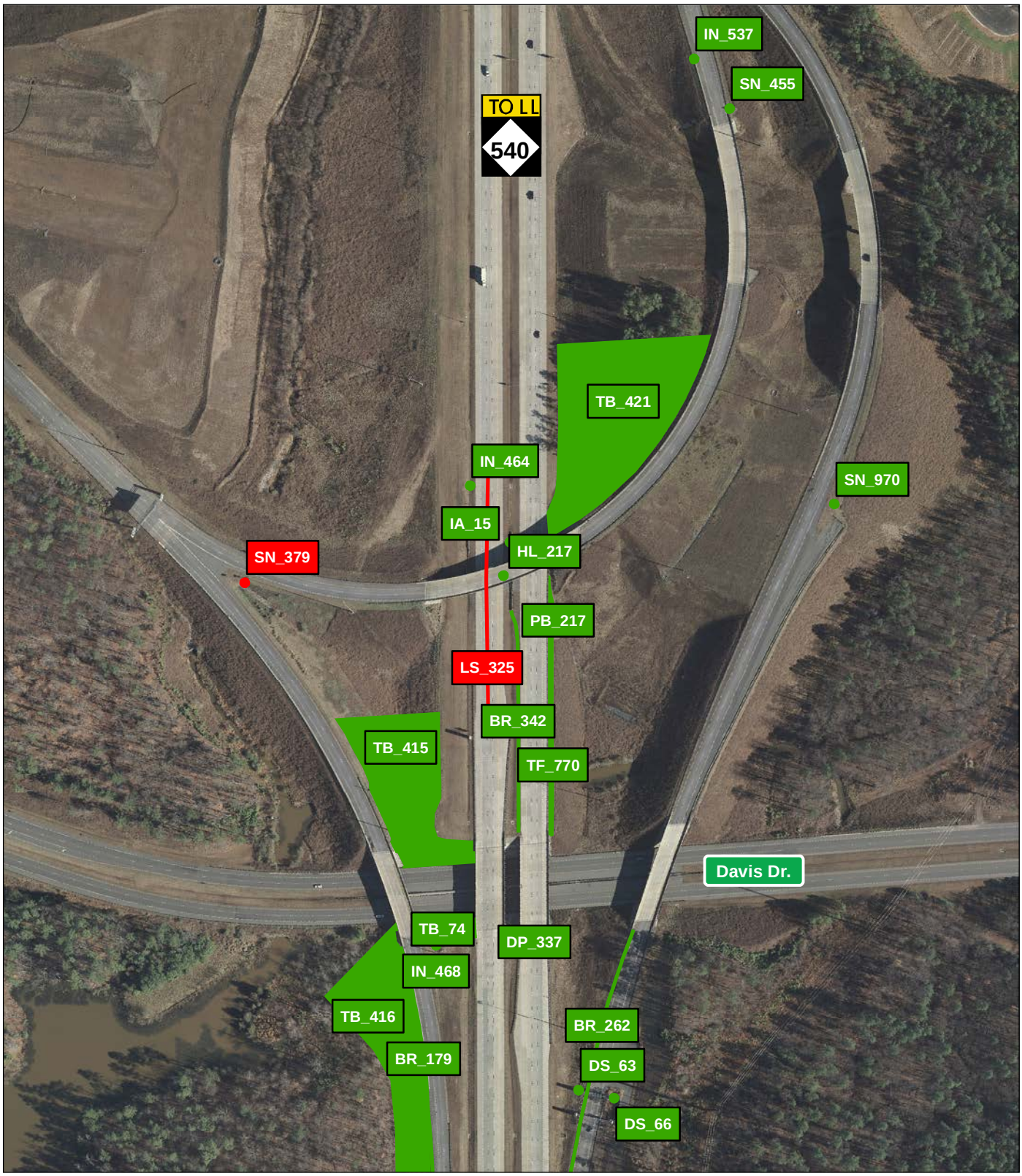

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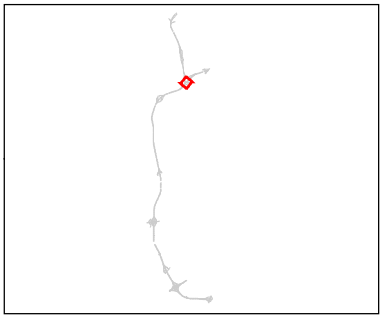

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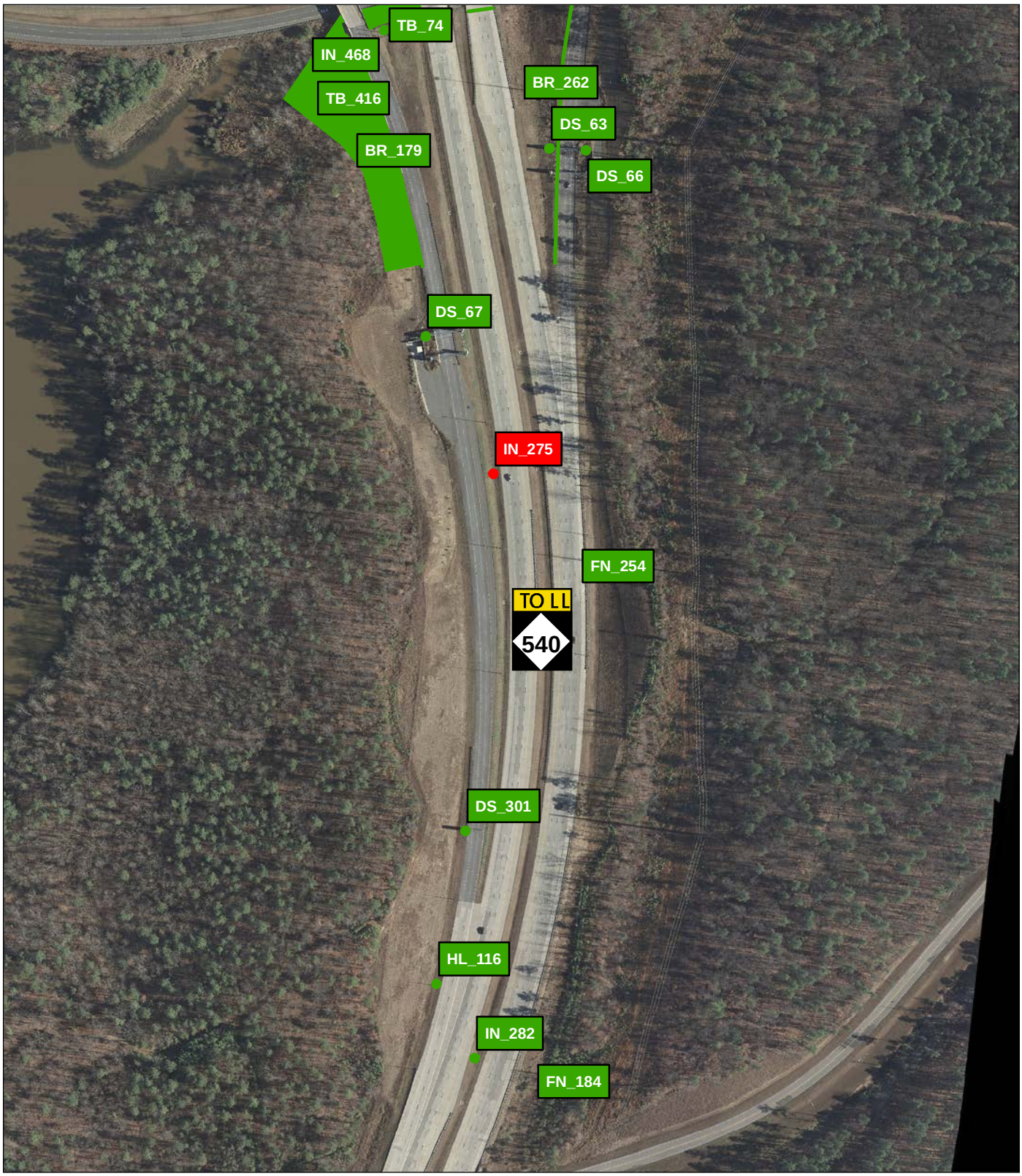

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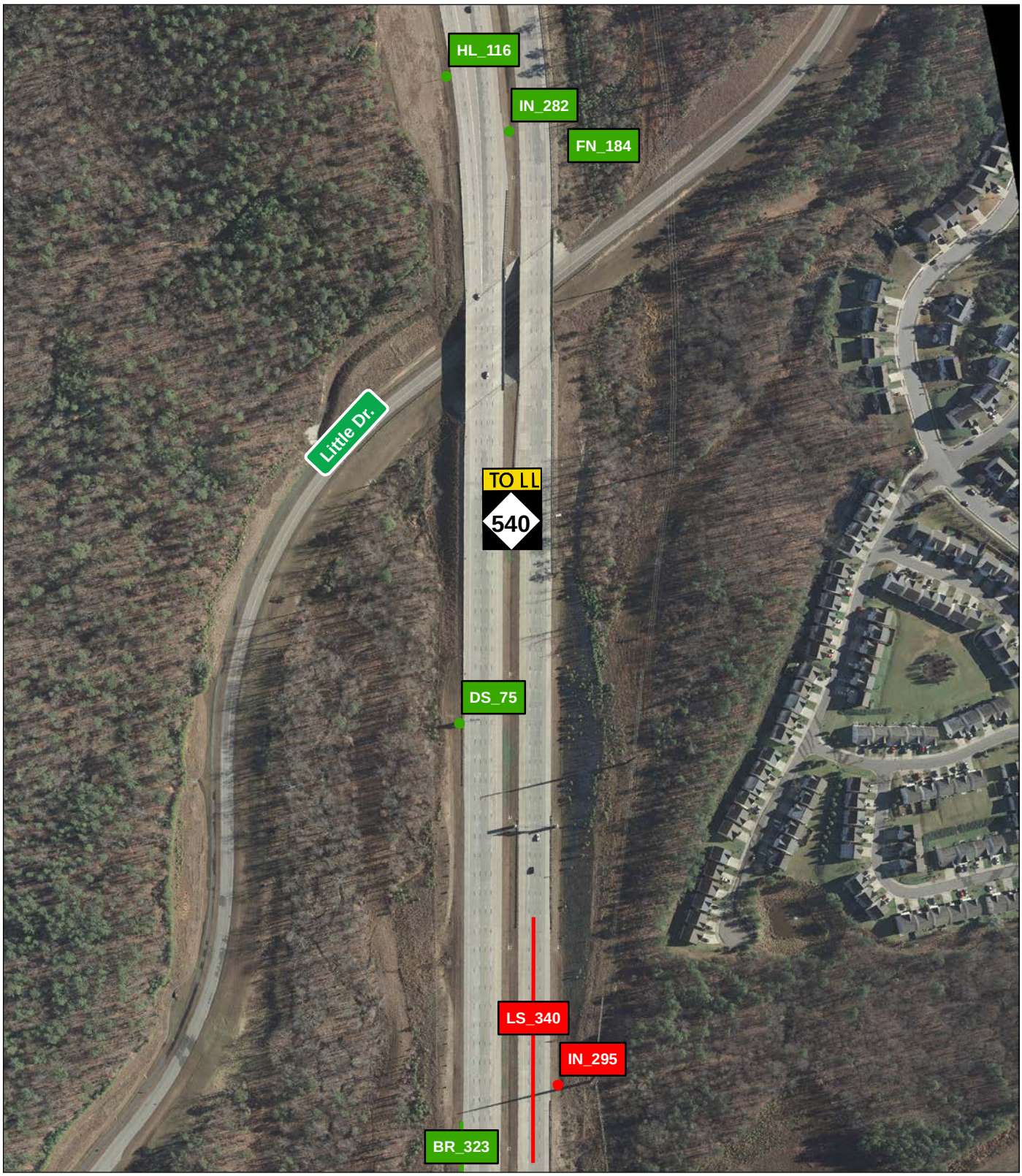

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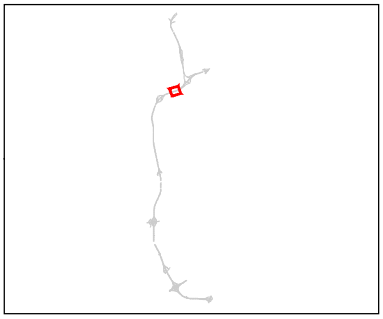

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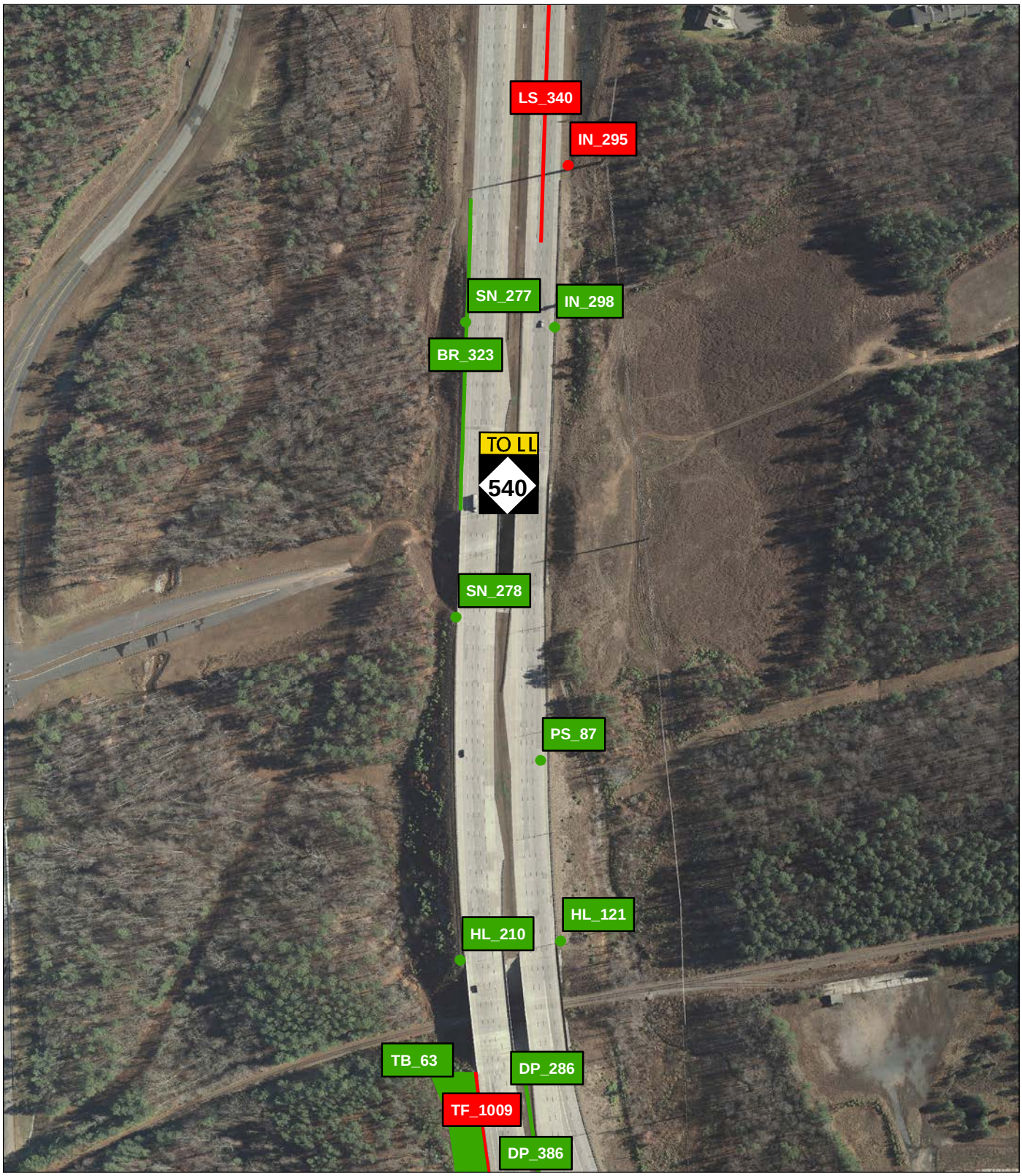

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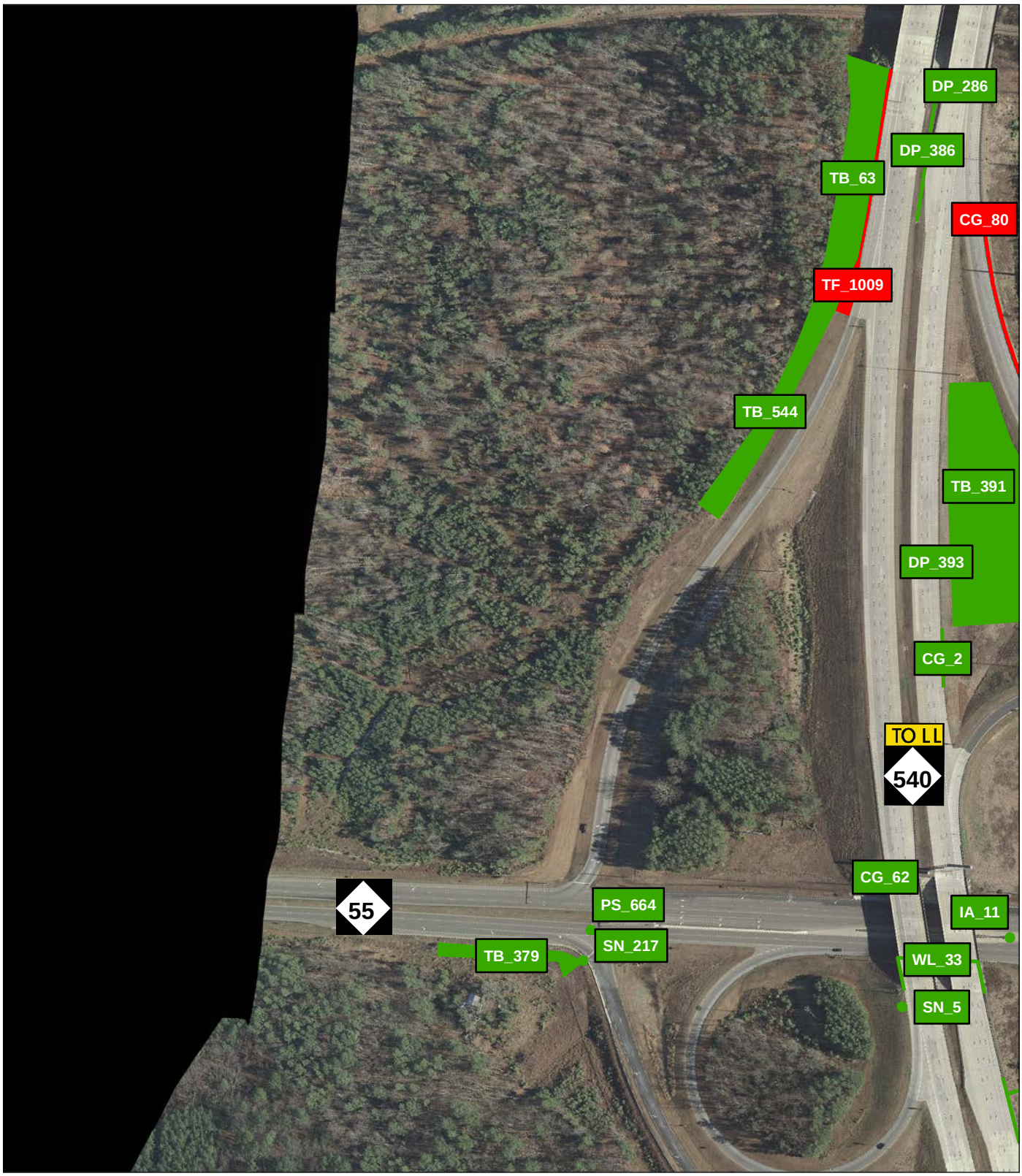

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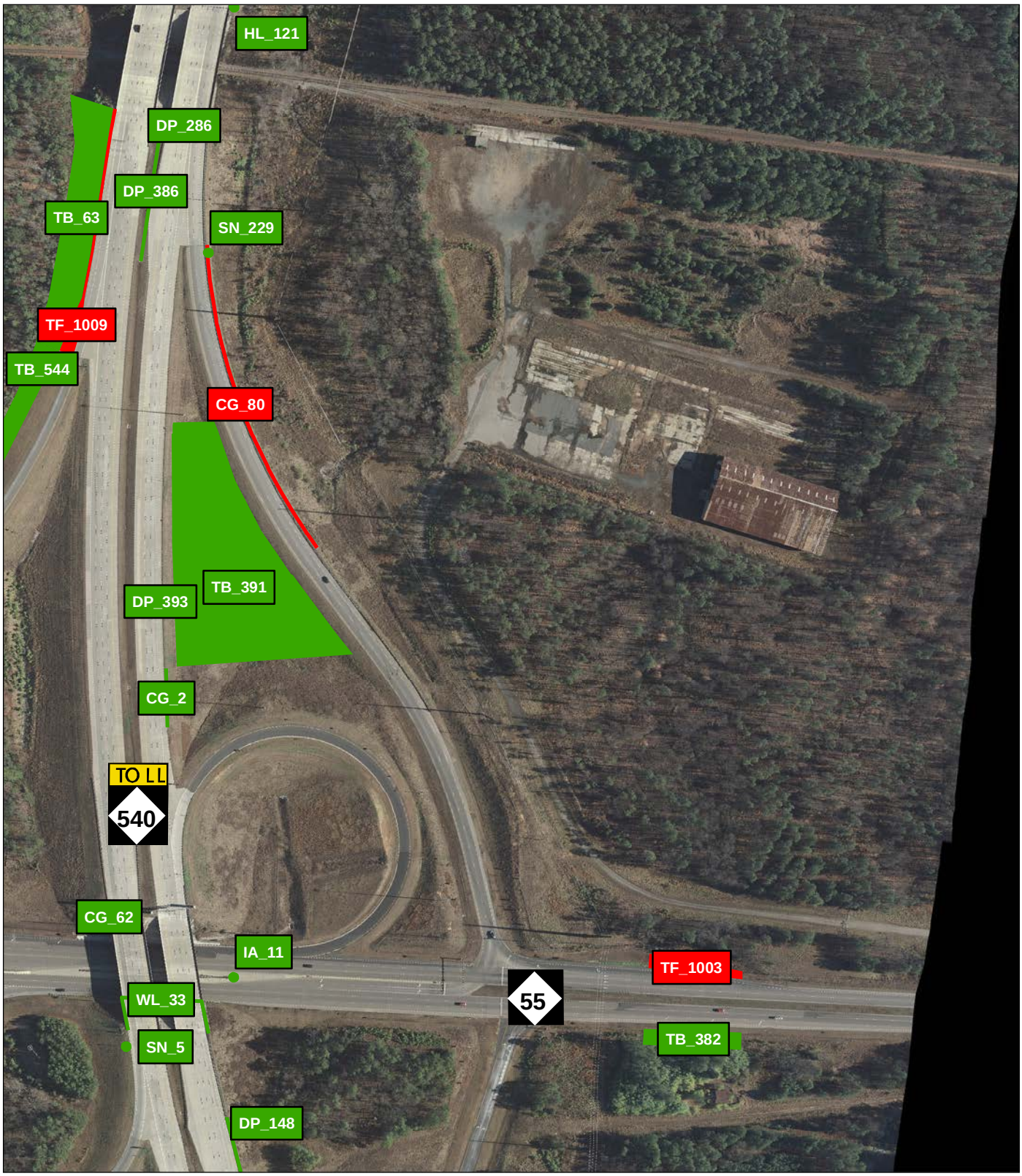

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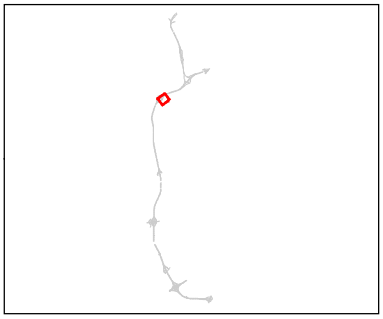

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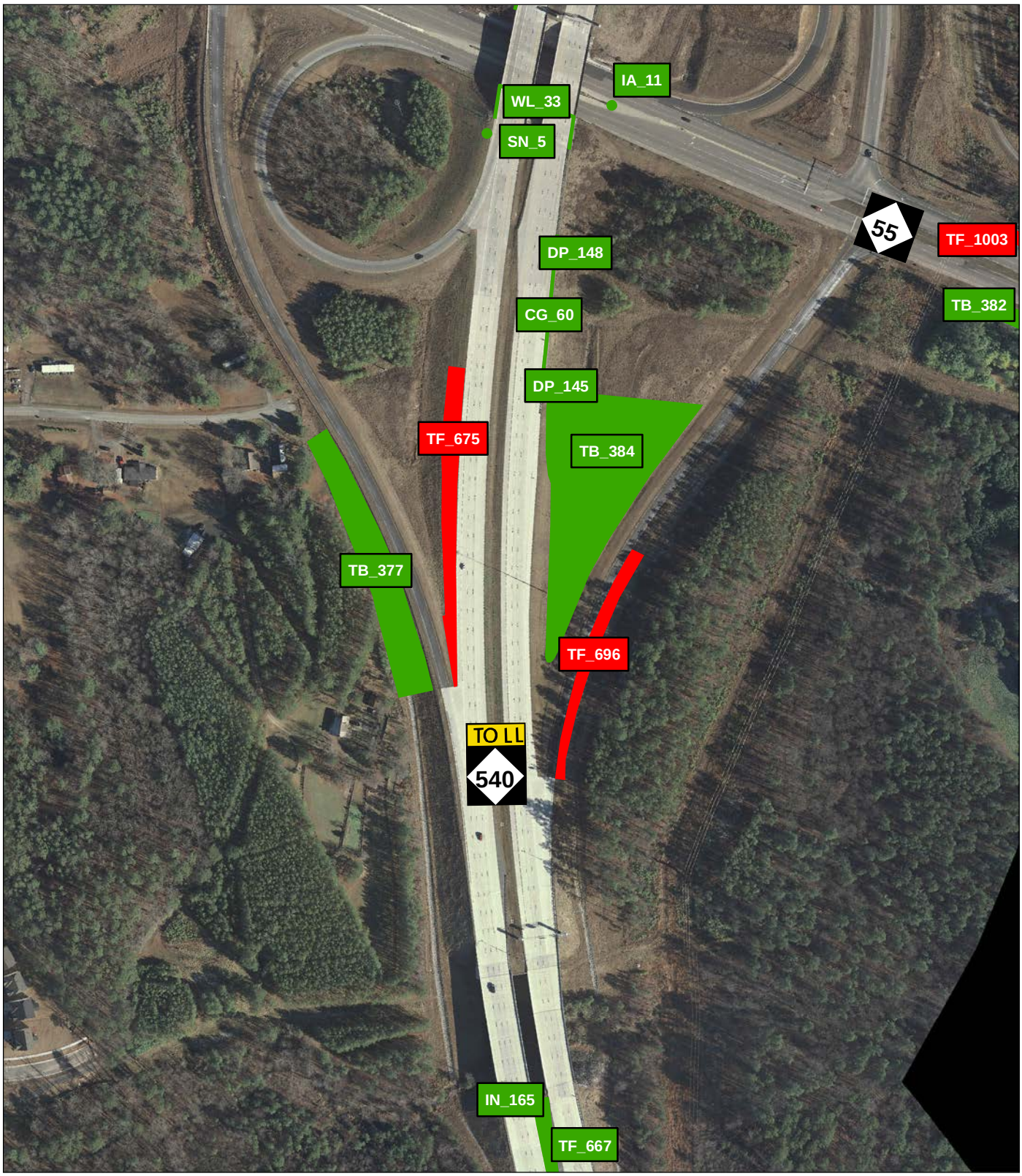

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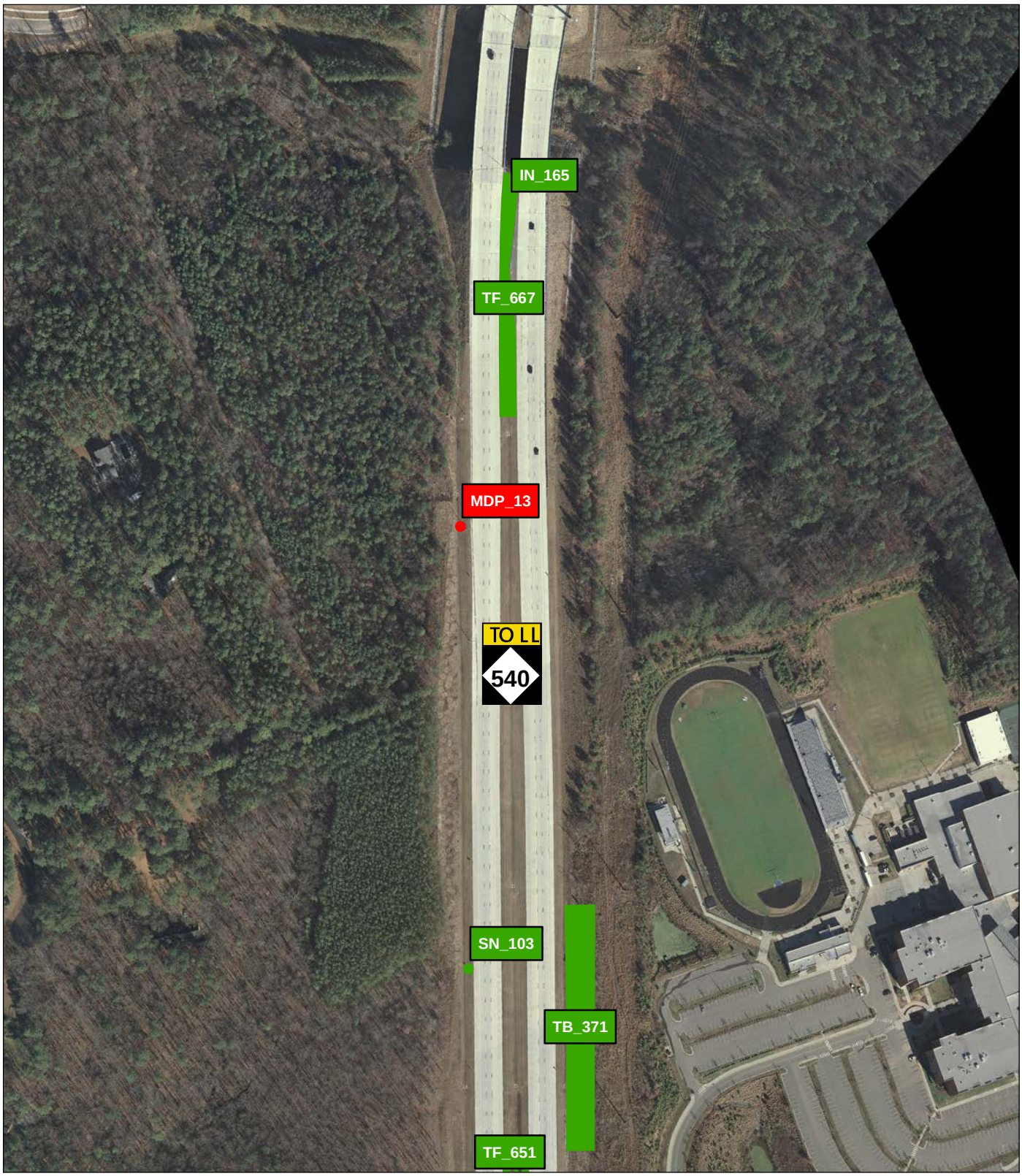

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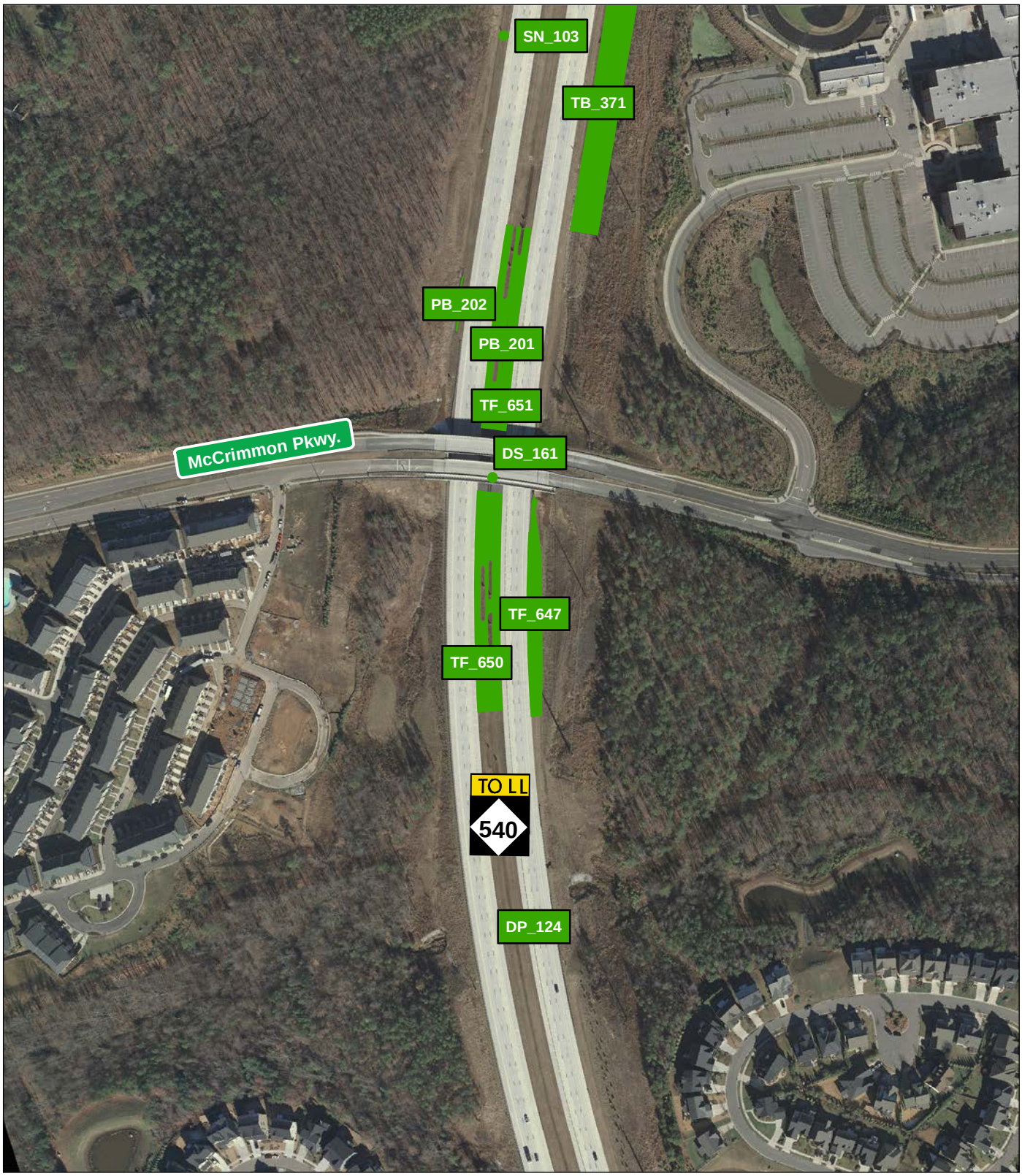

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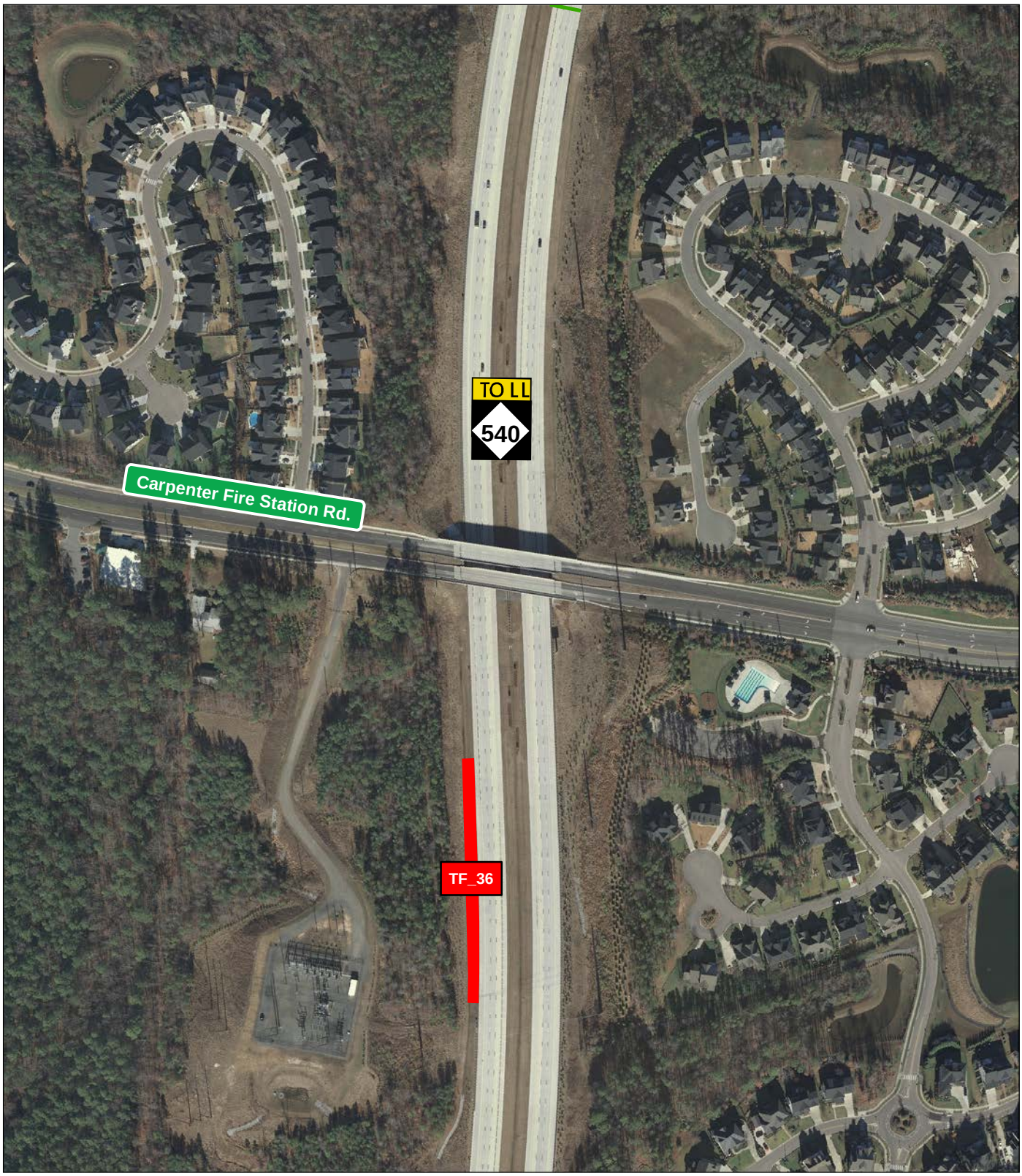

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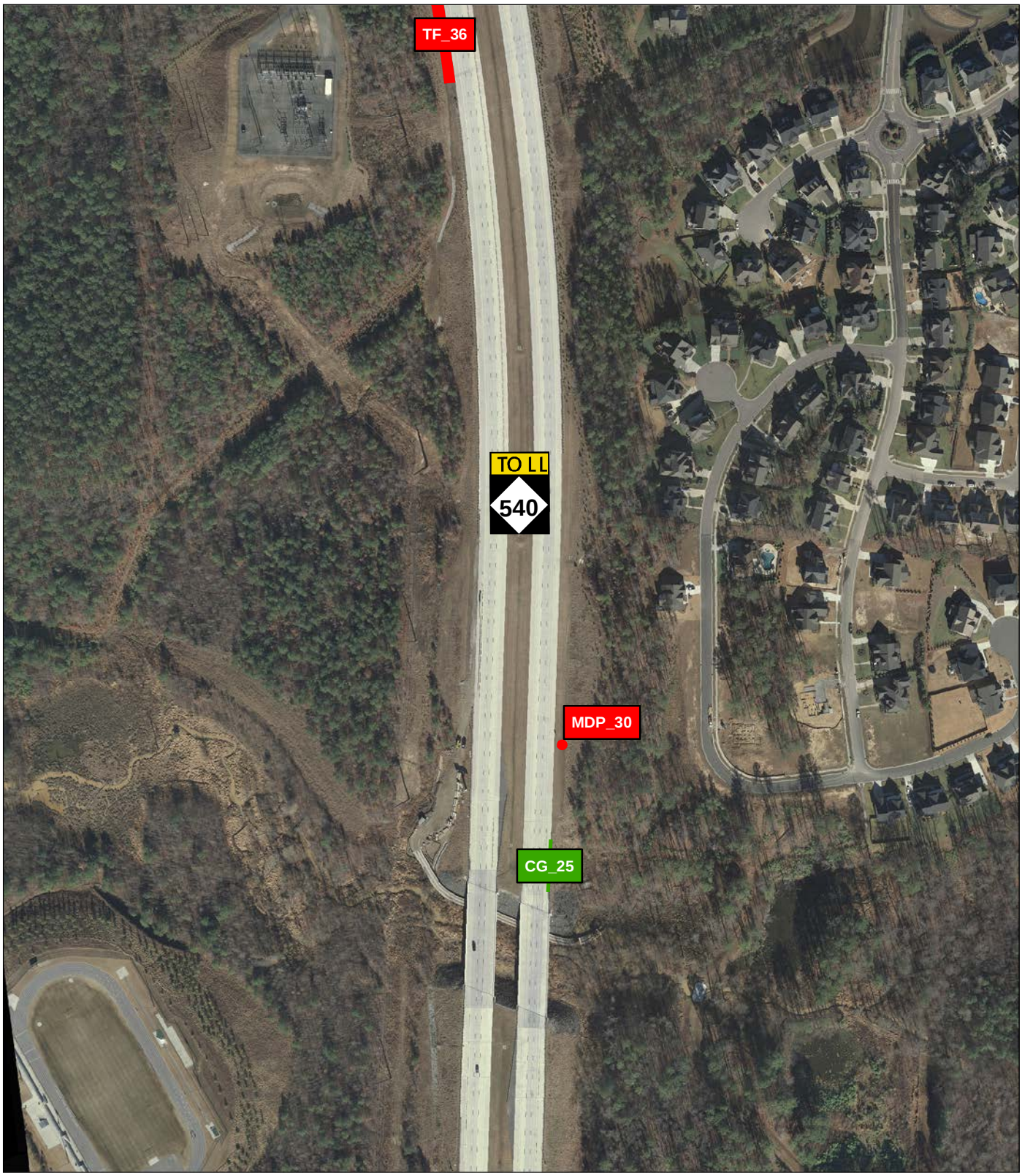

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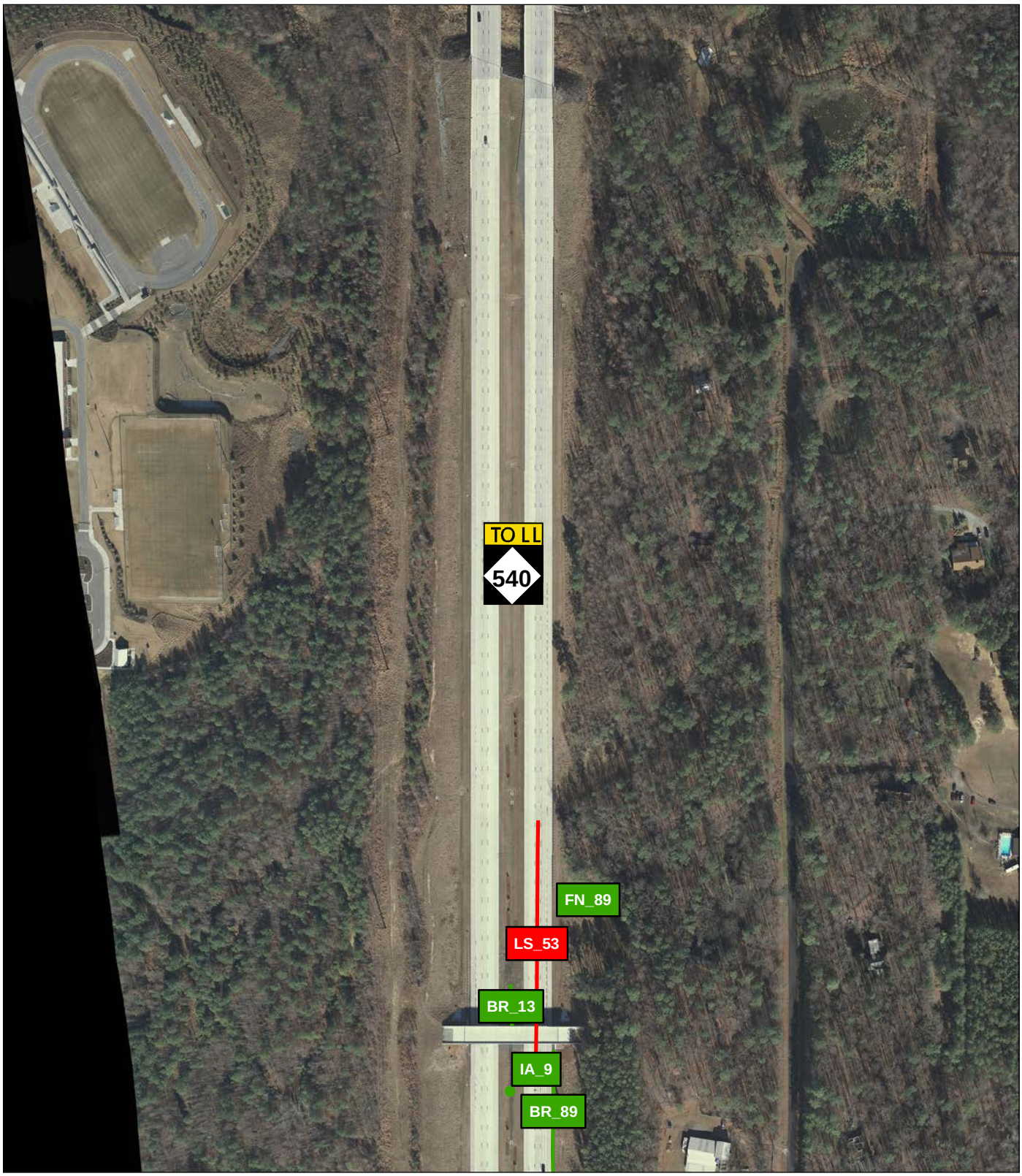

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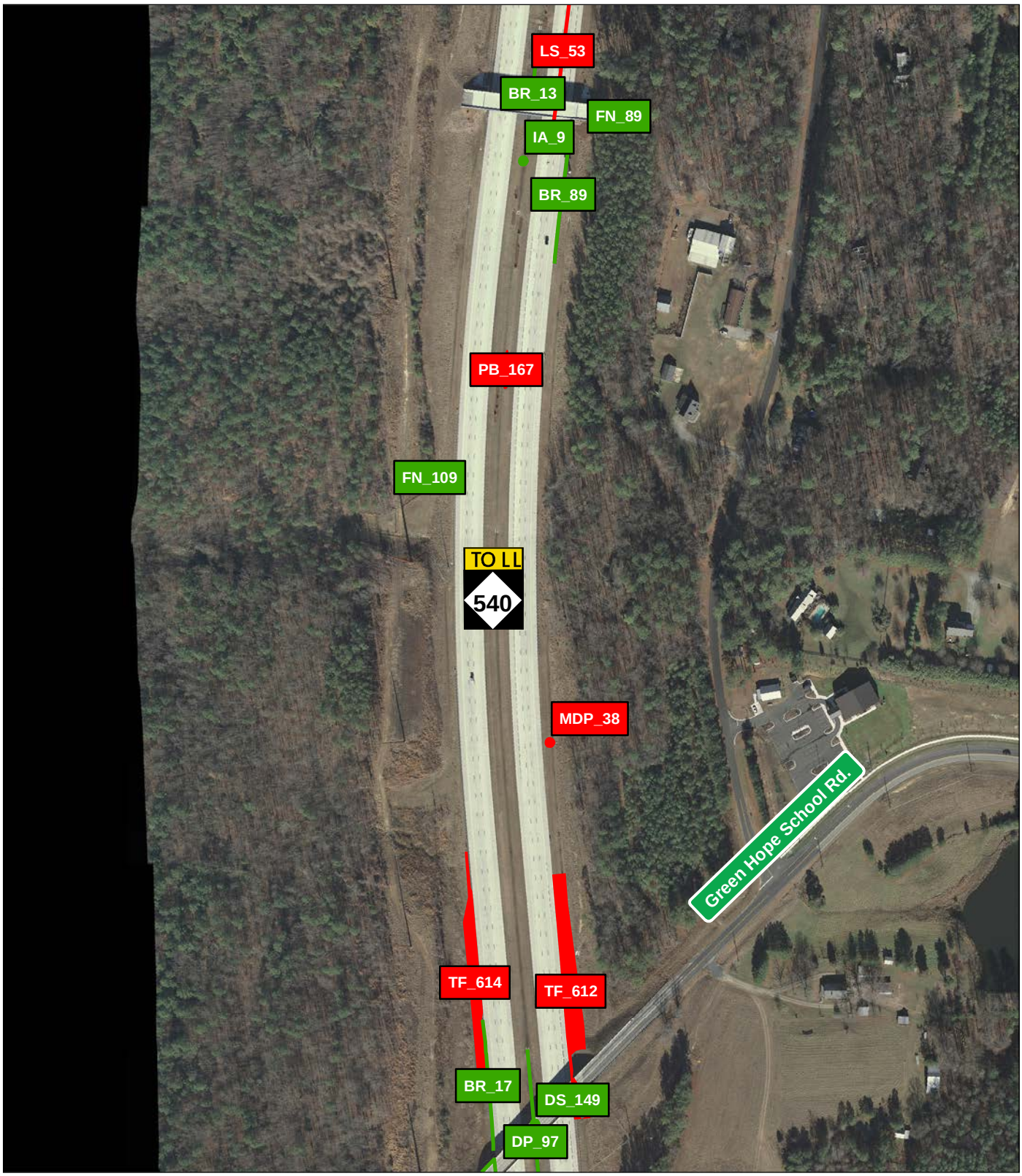

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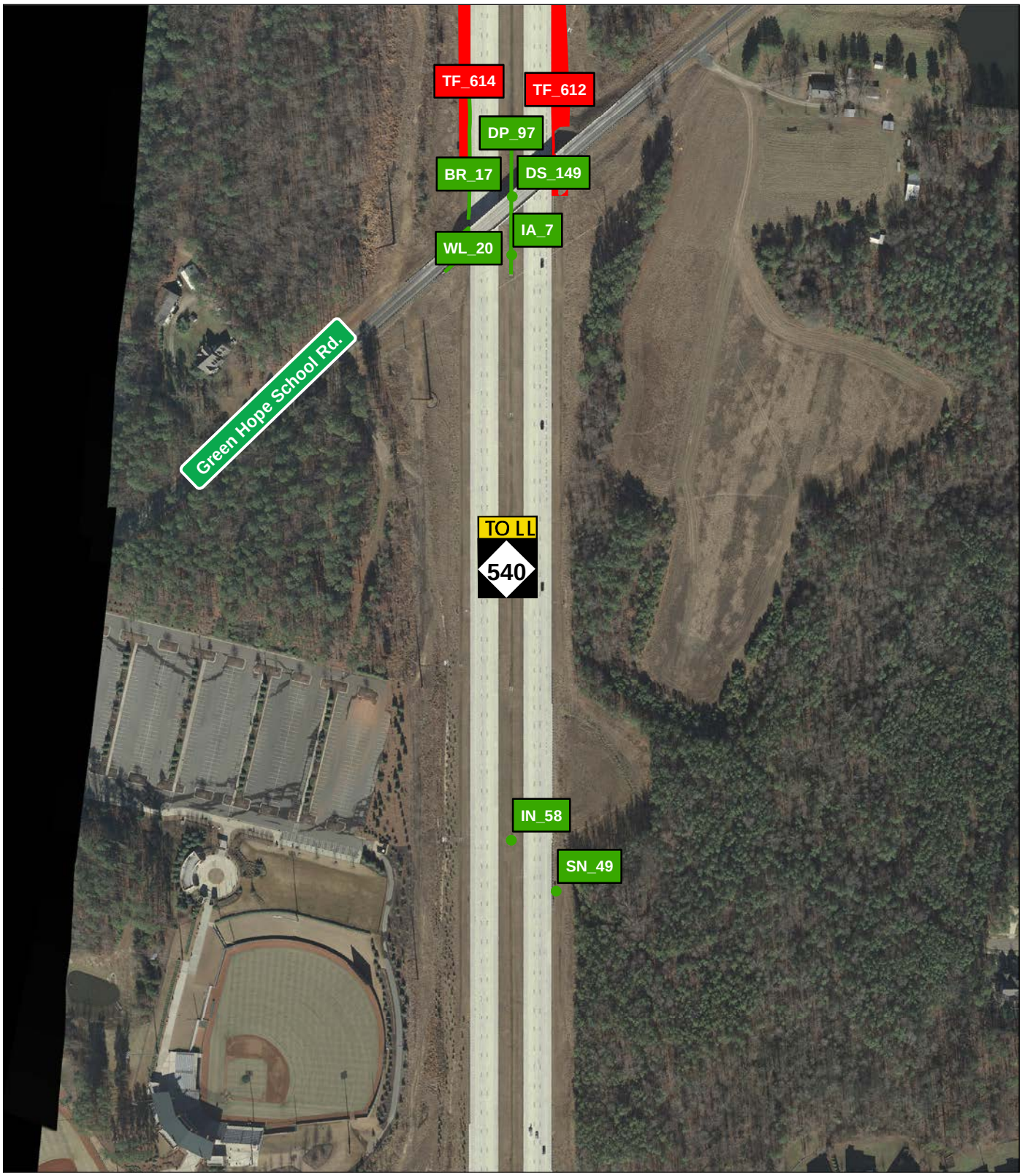

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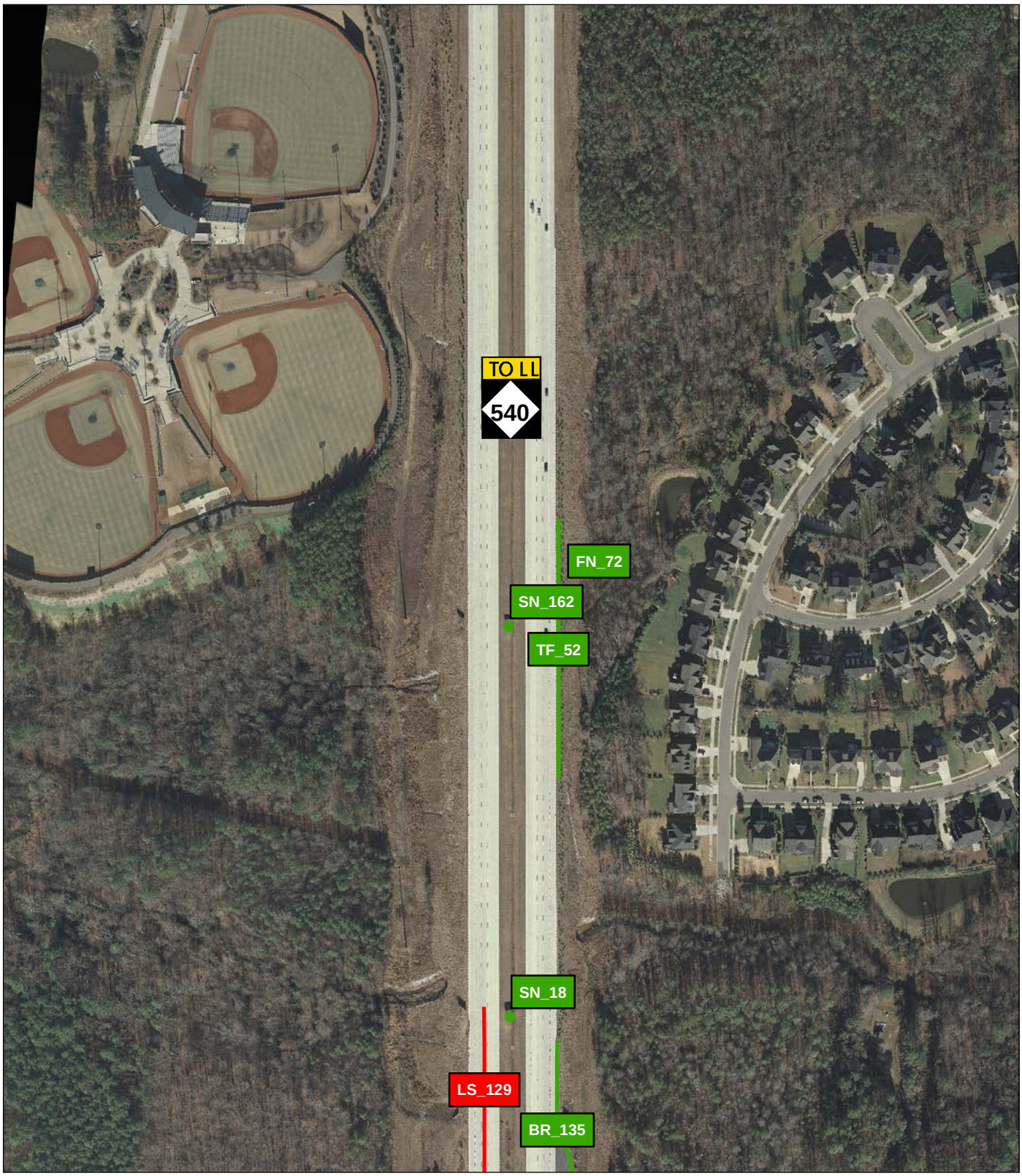

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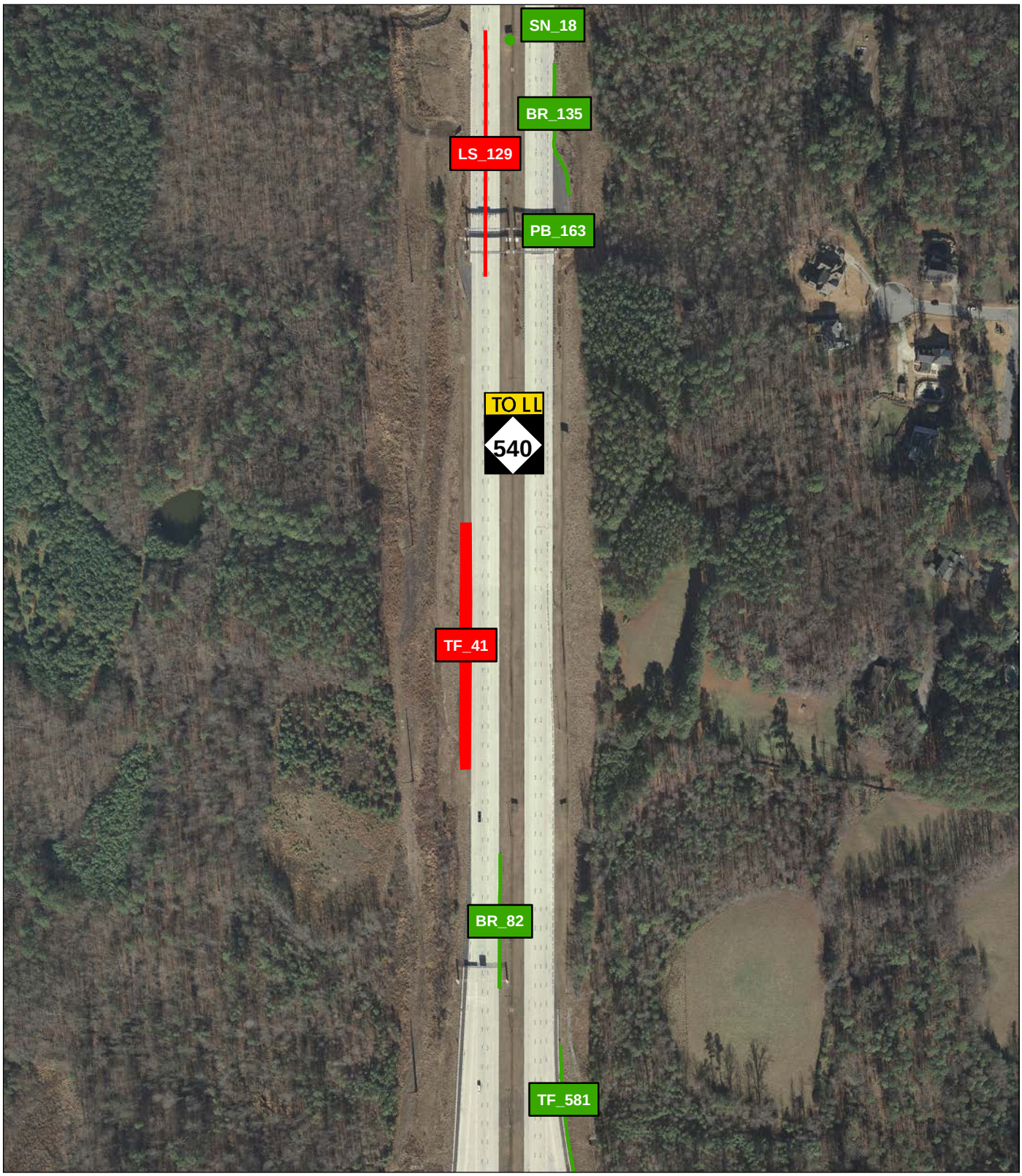

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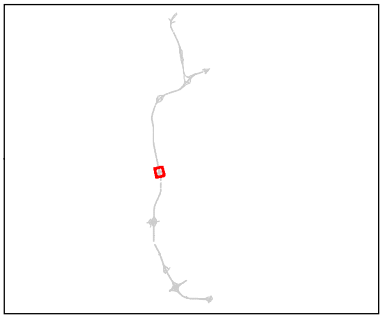

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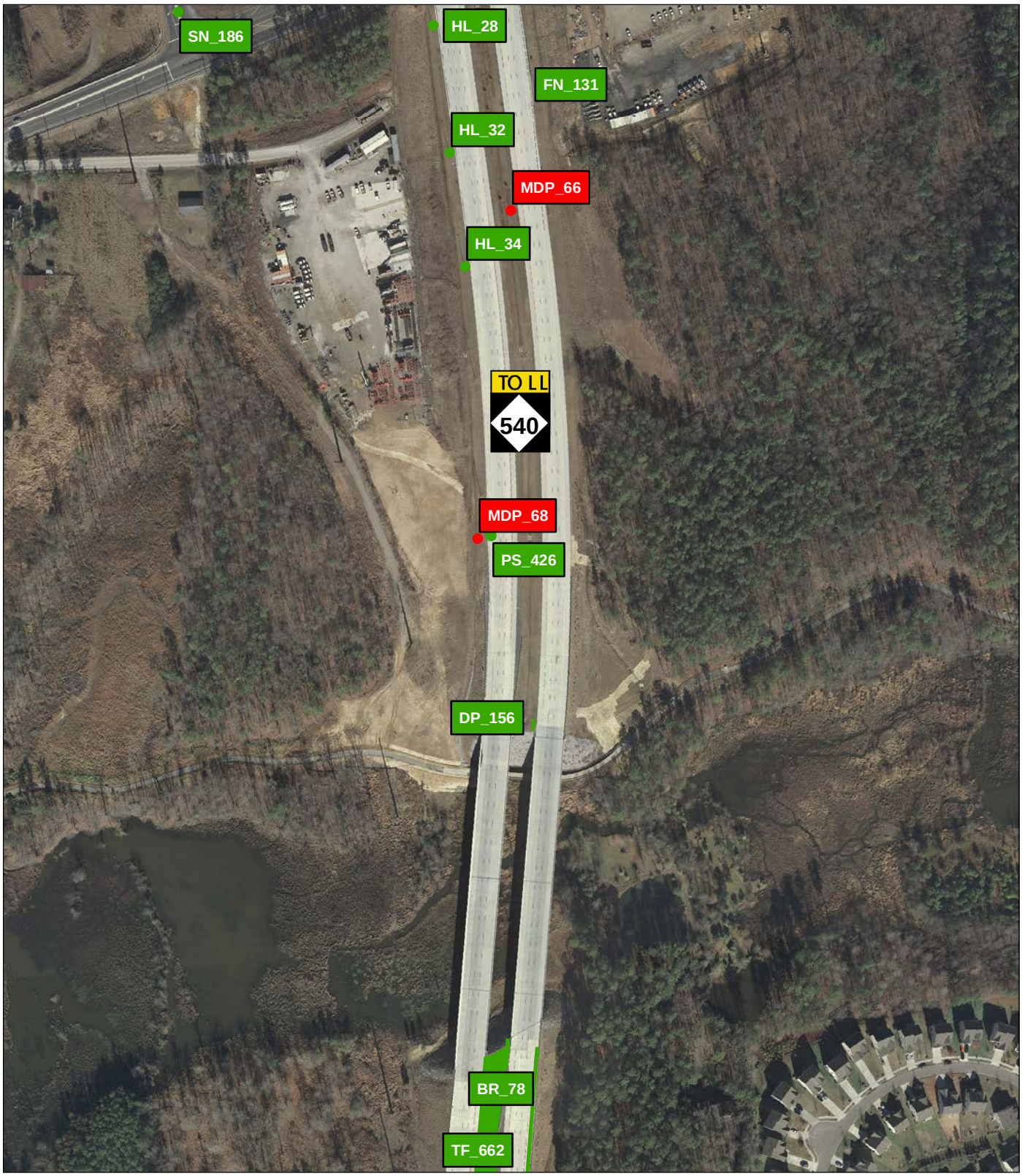

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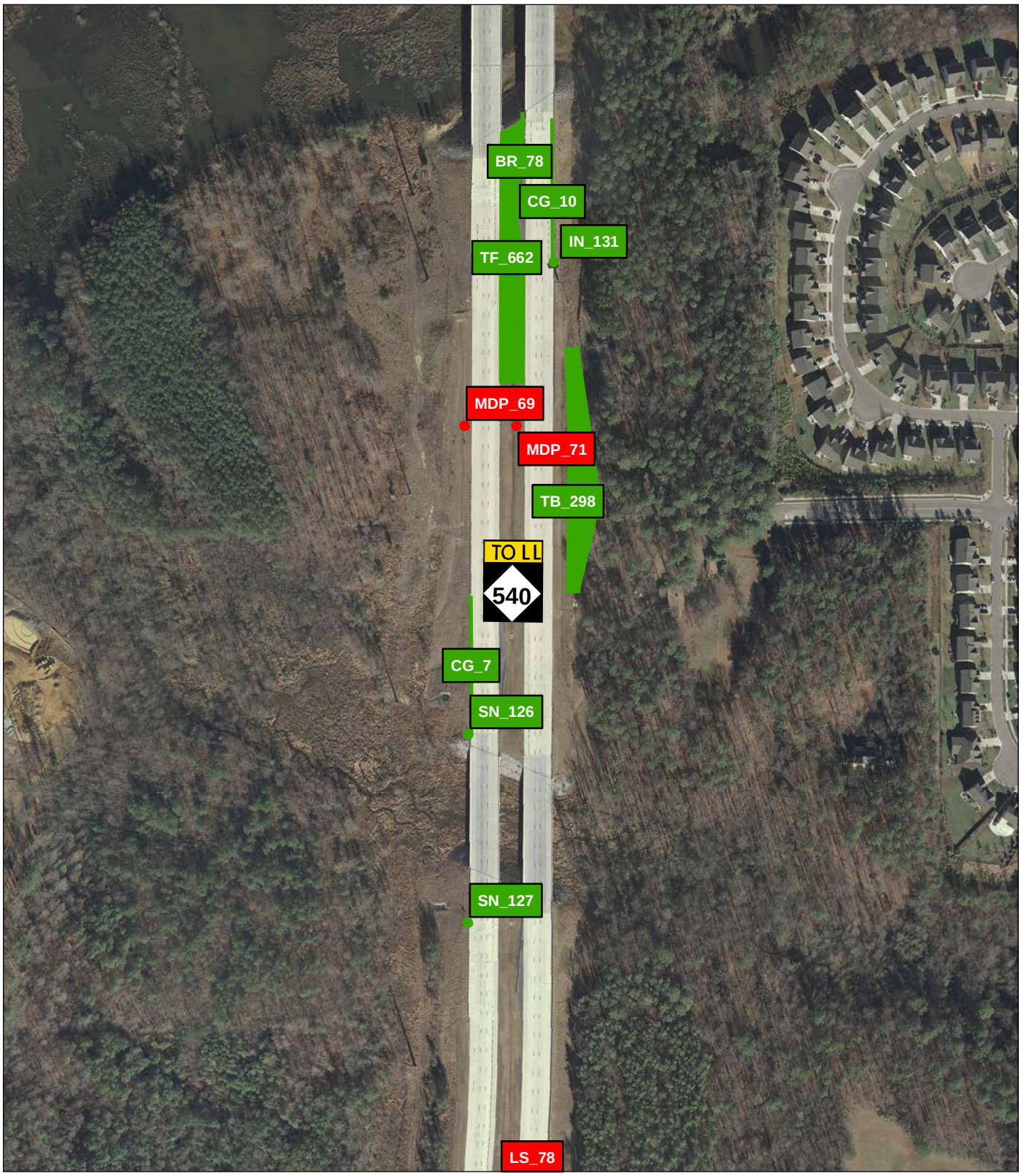

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NORTH CAROLINA Turnpike Authority

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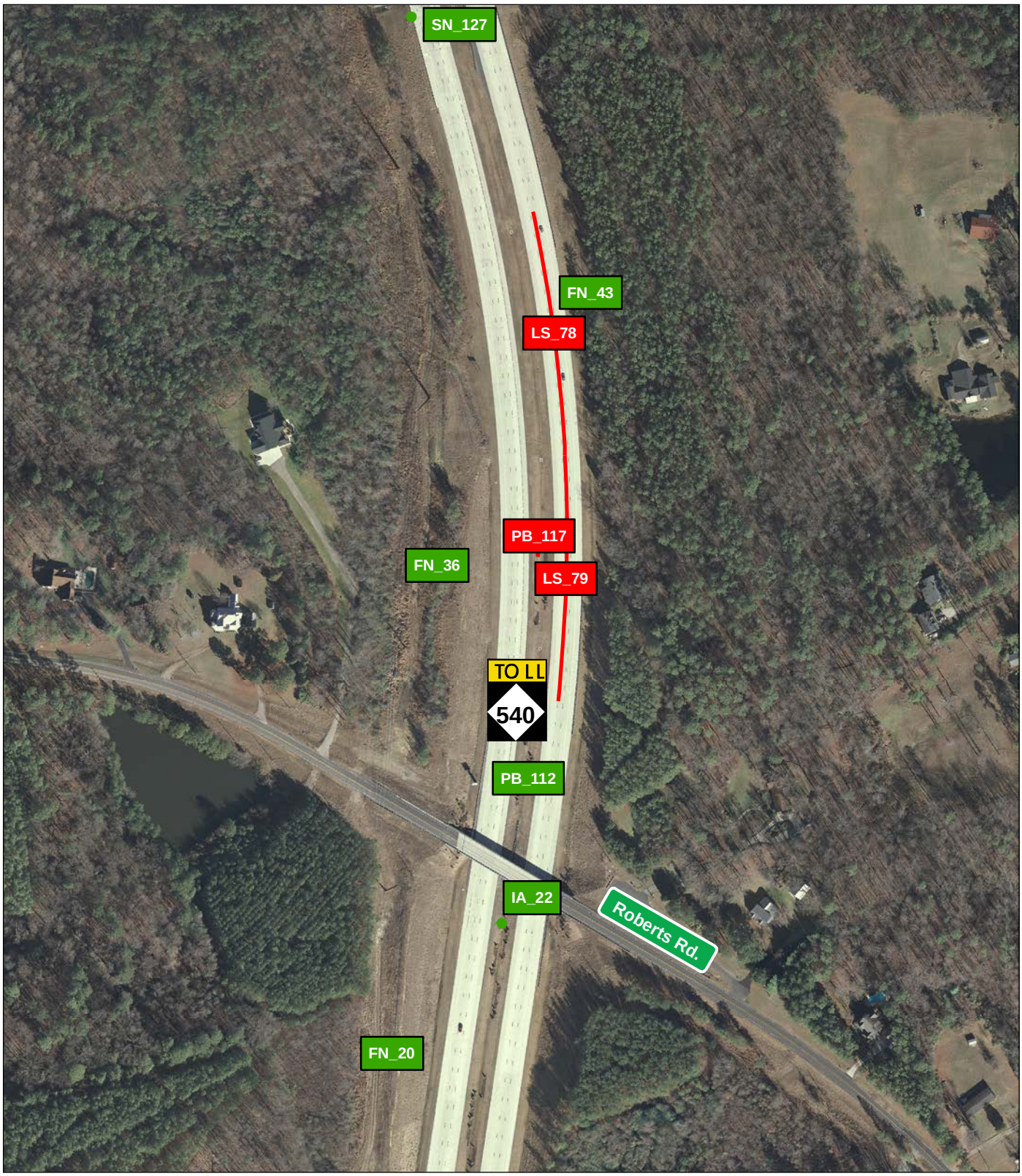

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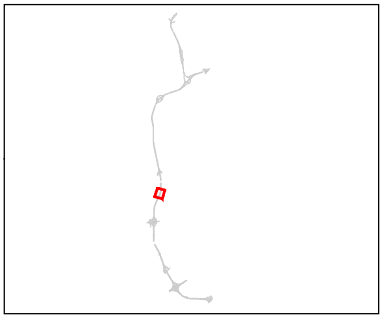

NORTH CAROLINA Turnpike Authority

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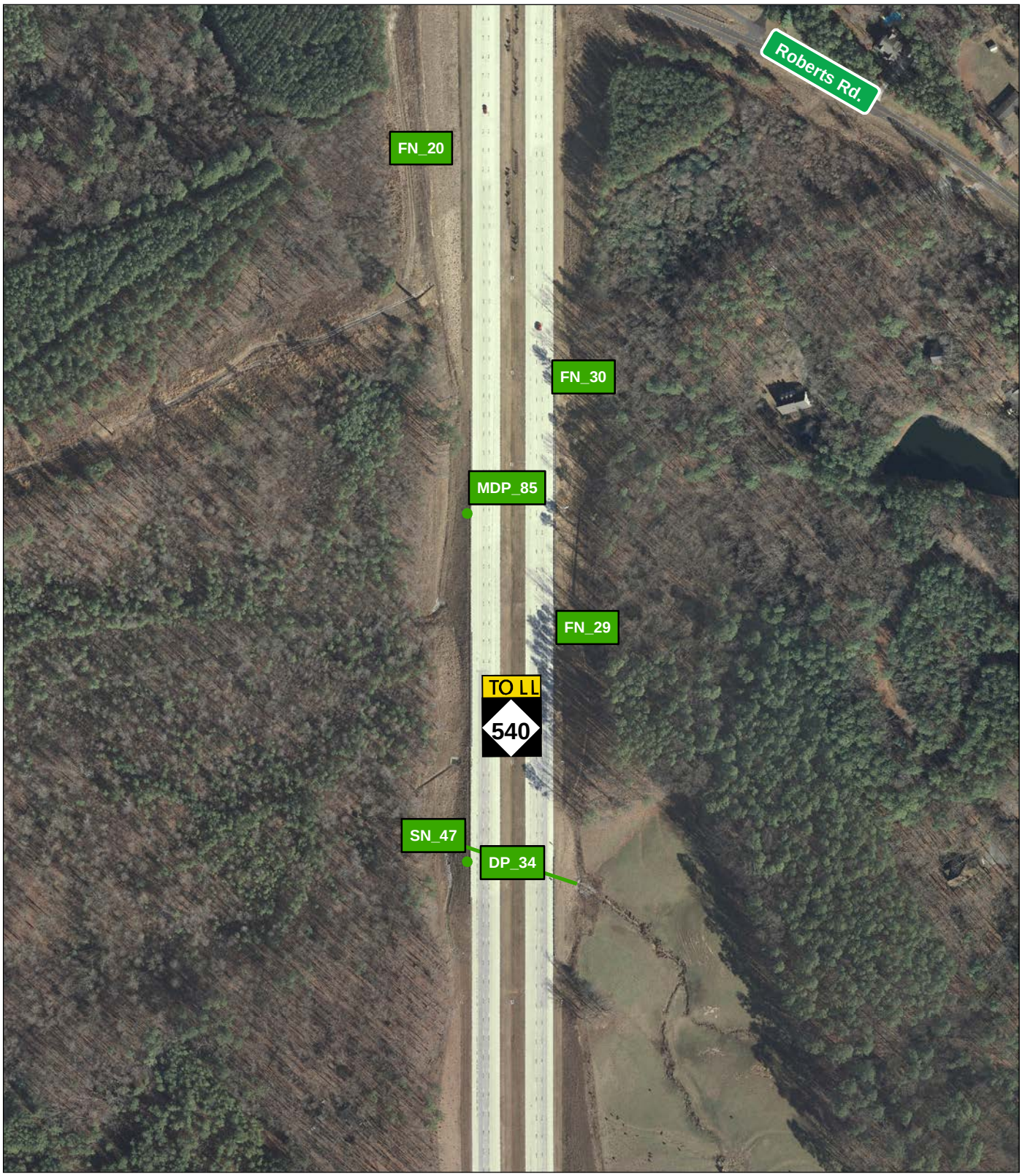

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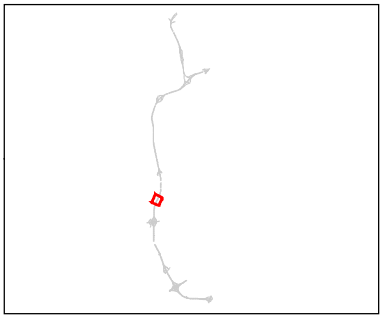
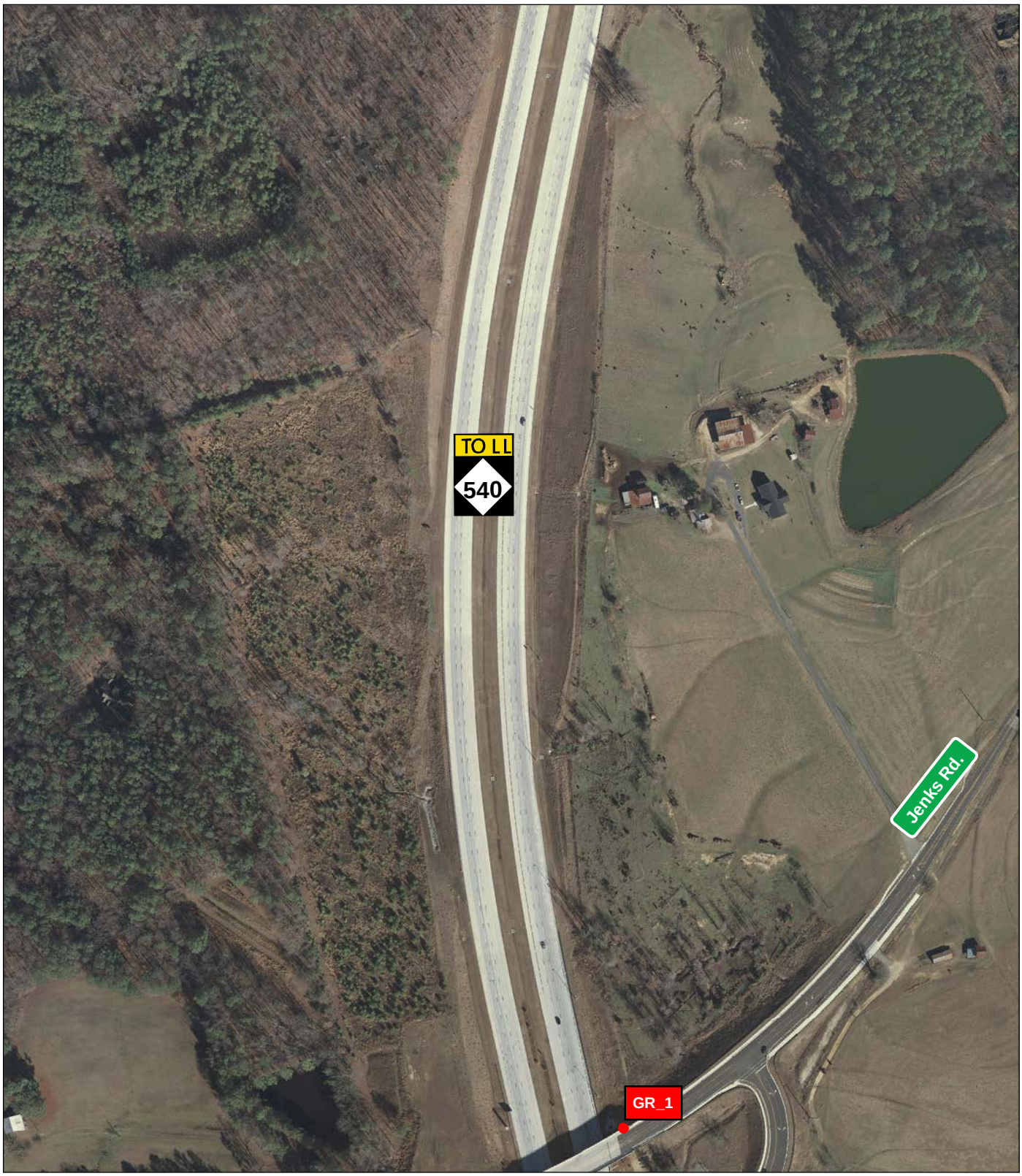


NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2014 Fourth Quarter Asset Assessment Locations



Legend

Passing Asset

Failing Asset

NORTH CAROLINA Turnpike Authority

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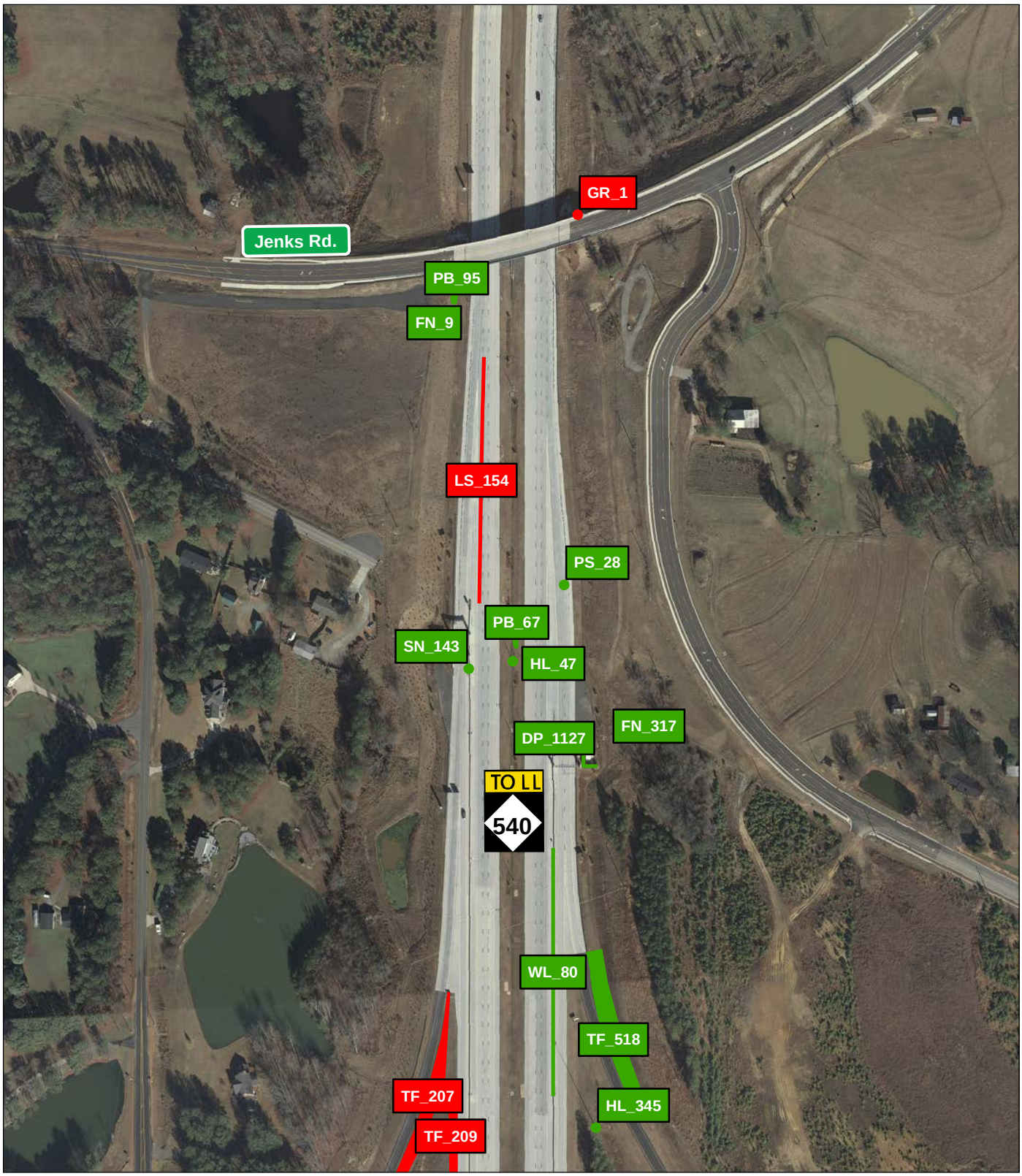

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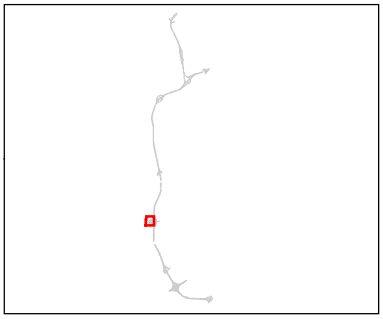

NORTH CAROLINA Turnpike Authority

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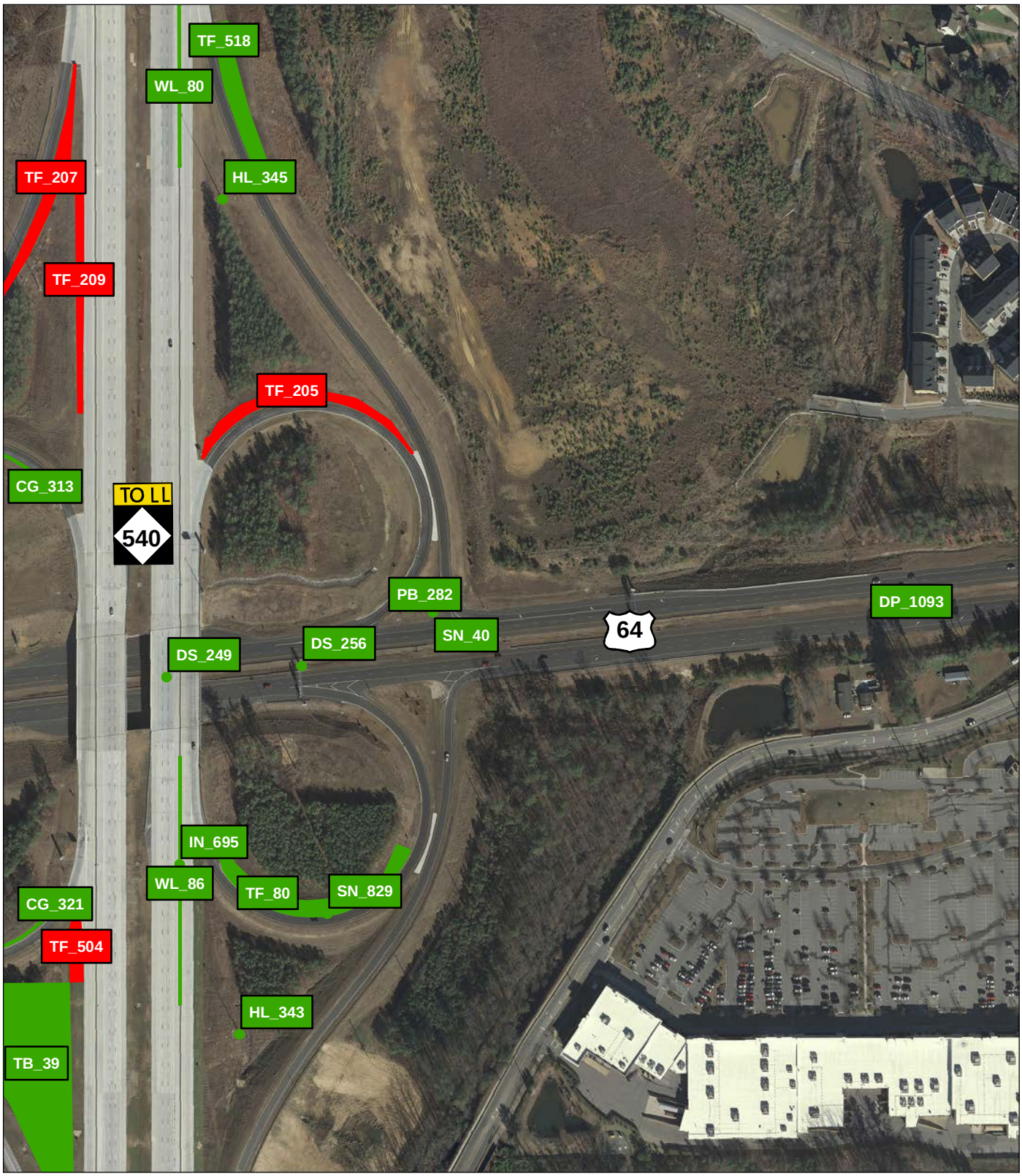

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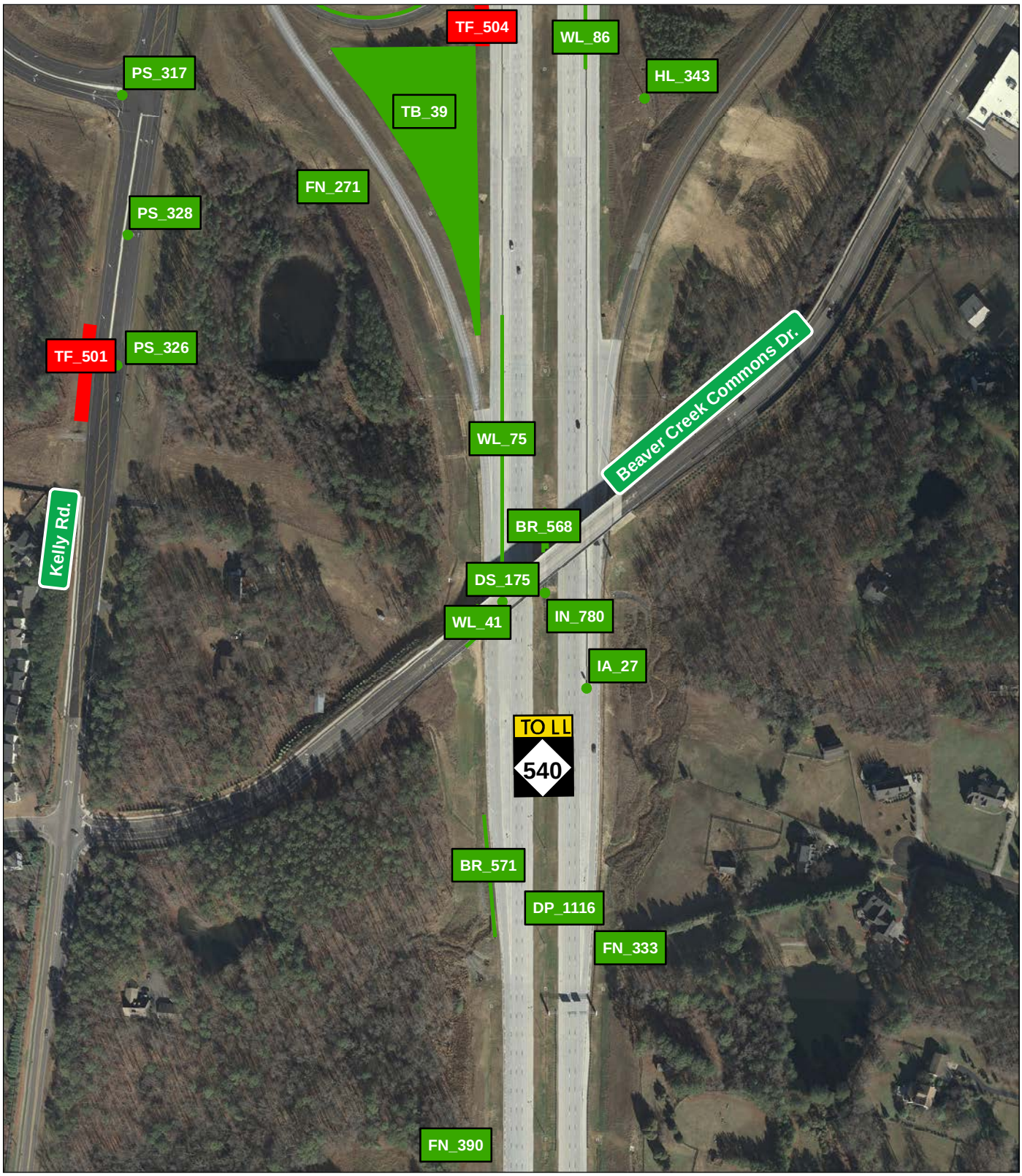

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NORTH CAROLINA Turnpike Authority

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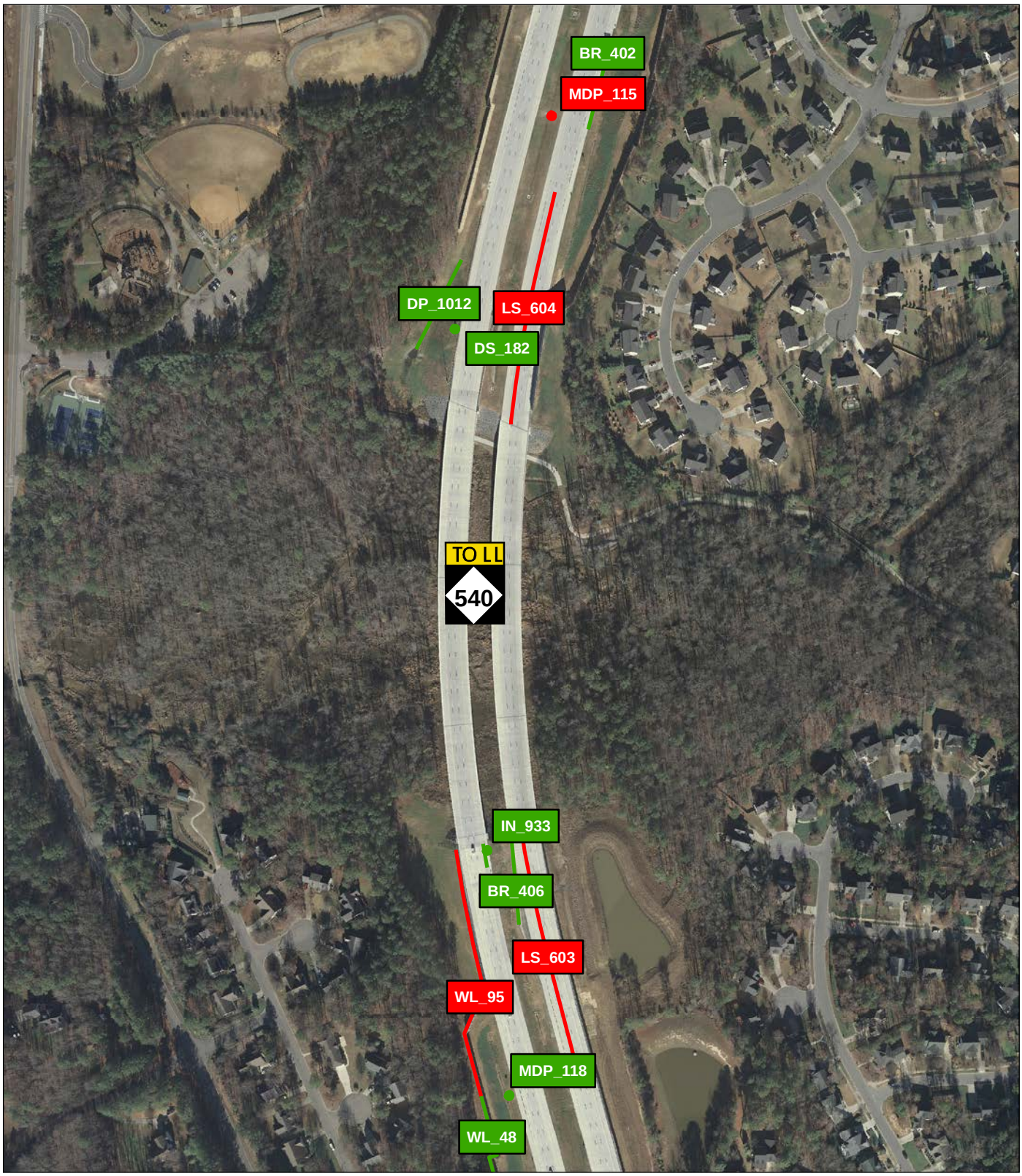

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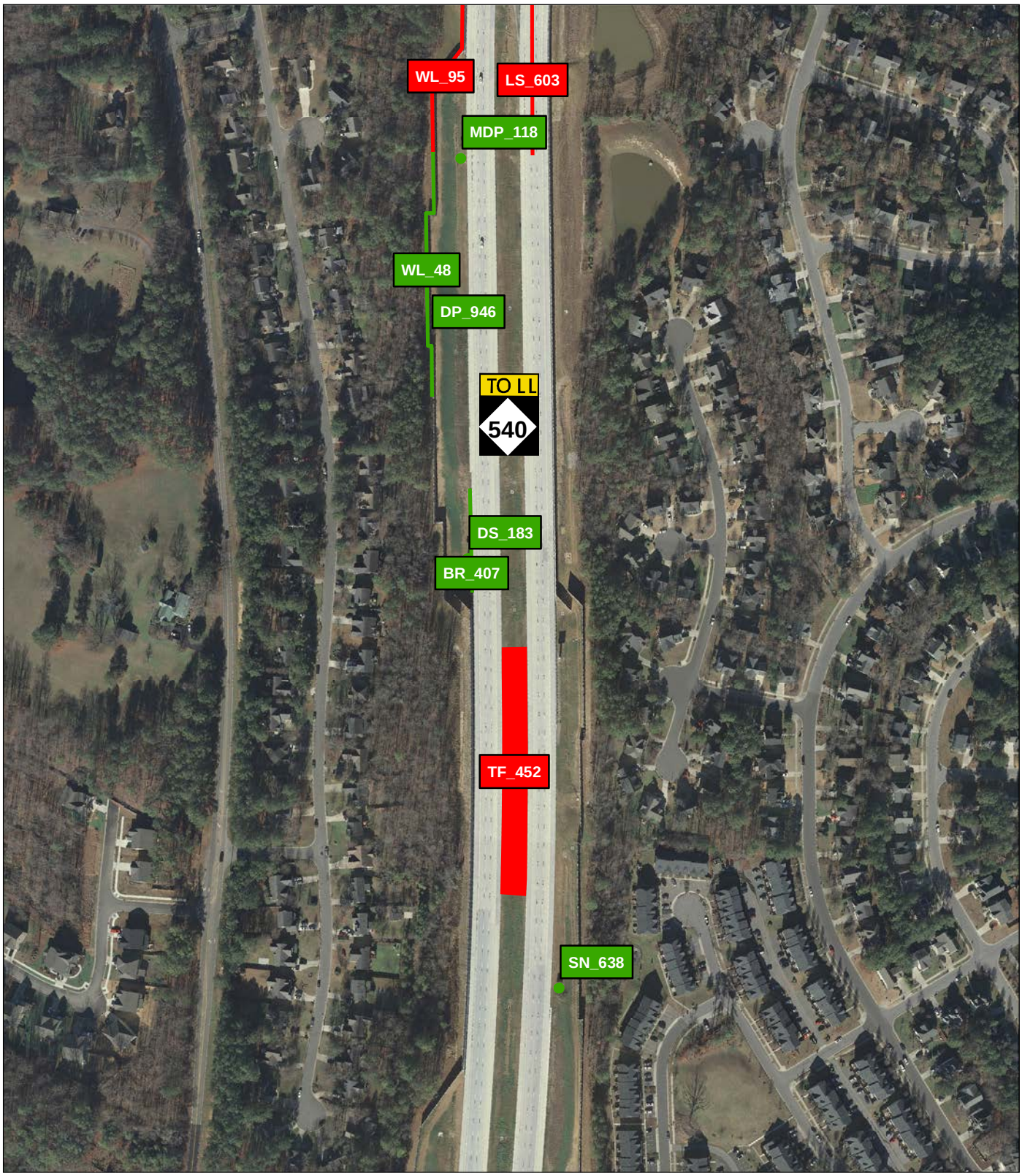

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NORTH CAROLINA Turnpike Authority

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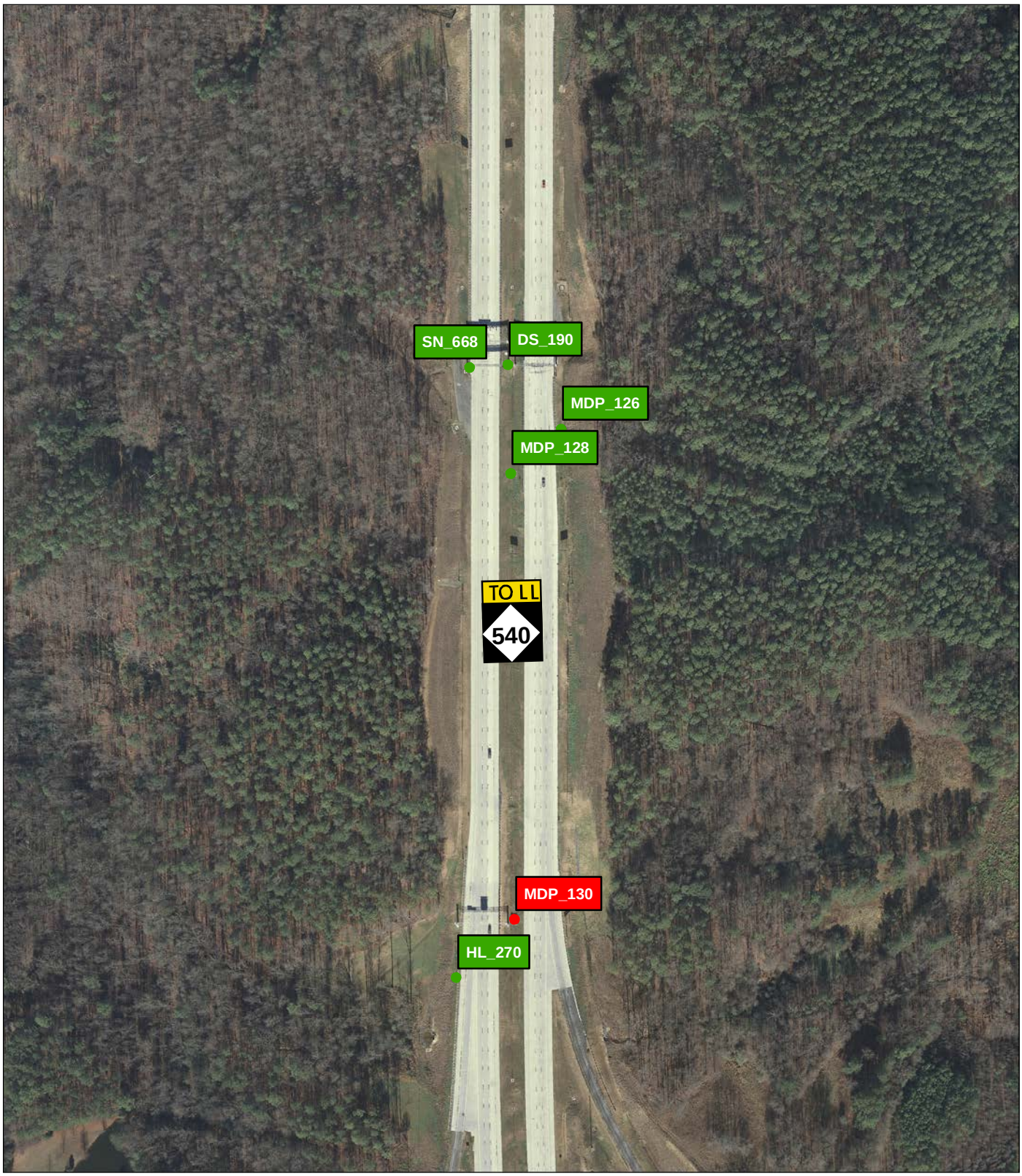

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NORTH CAROLINA
Turnpike Authority

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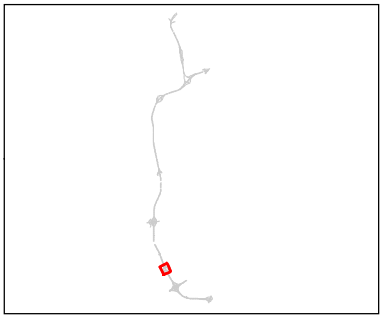

NORTH CAROLINA Turnpike Authority

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NORTH CAROLINA Turnpike Authority

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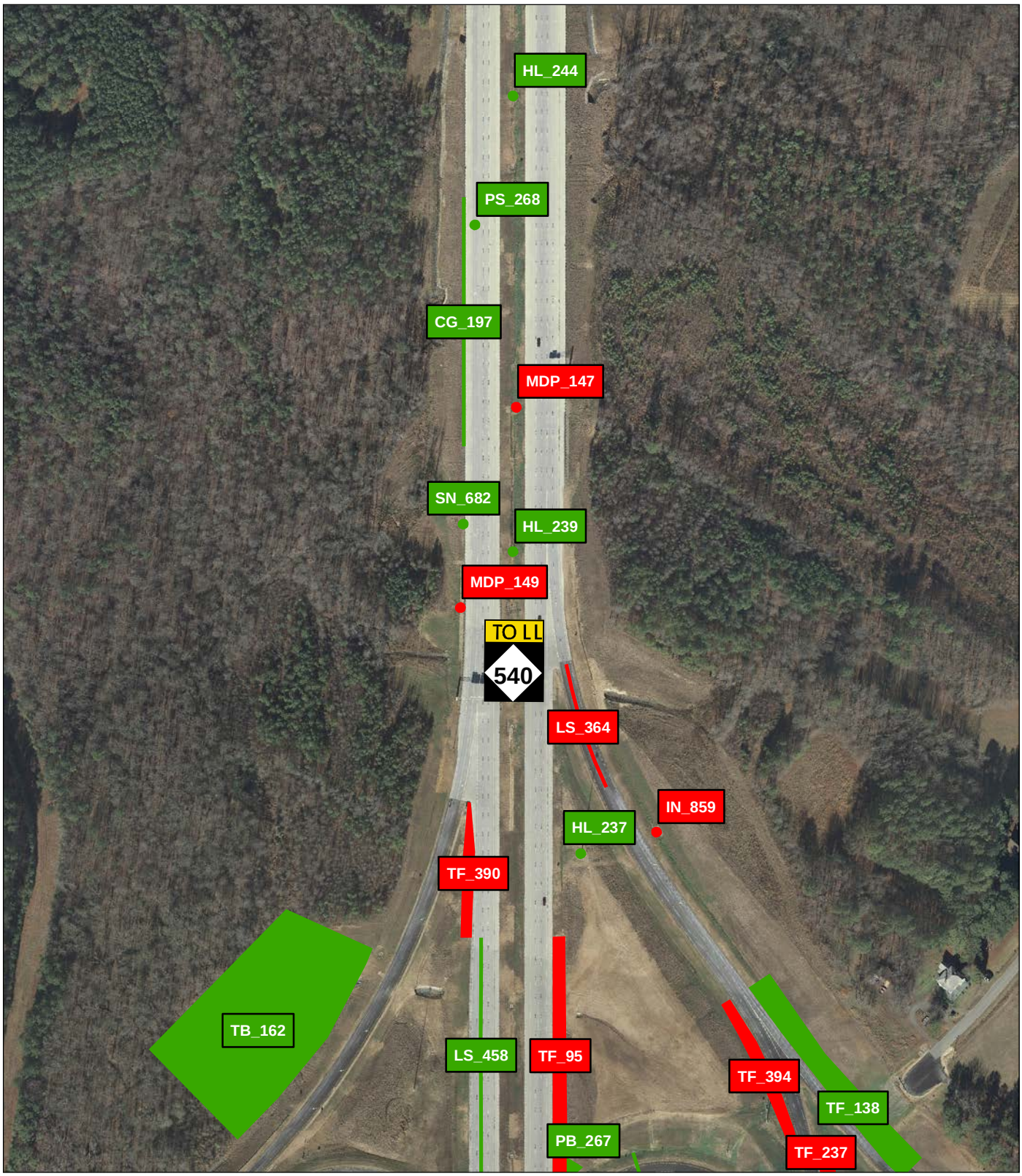

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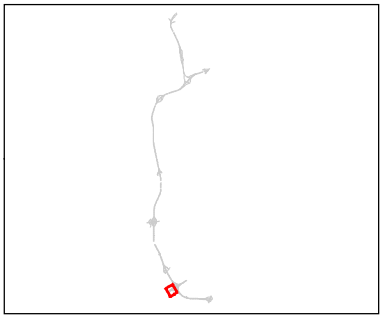

NORTH CAROLINA Turnpike Authority

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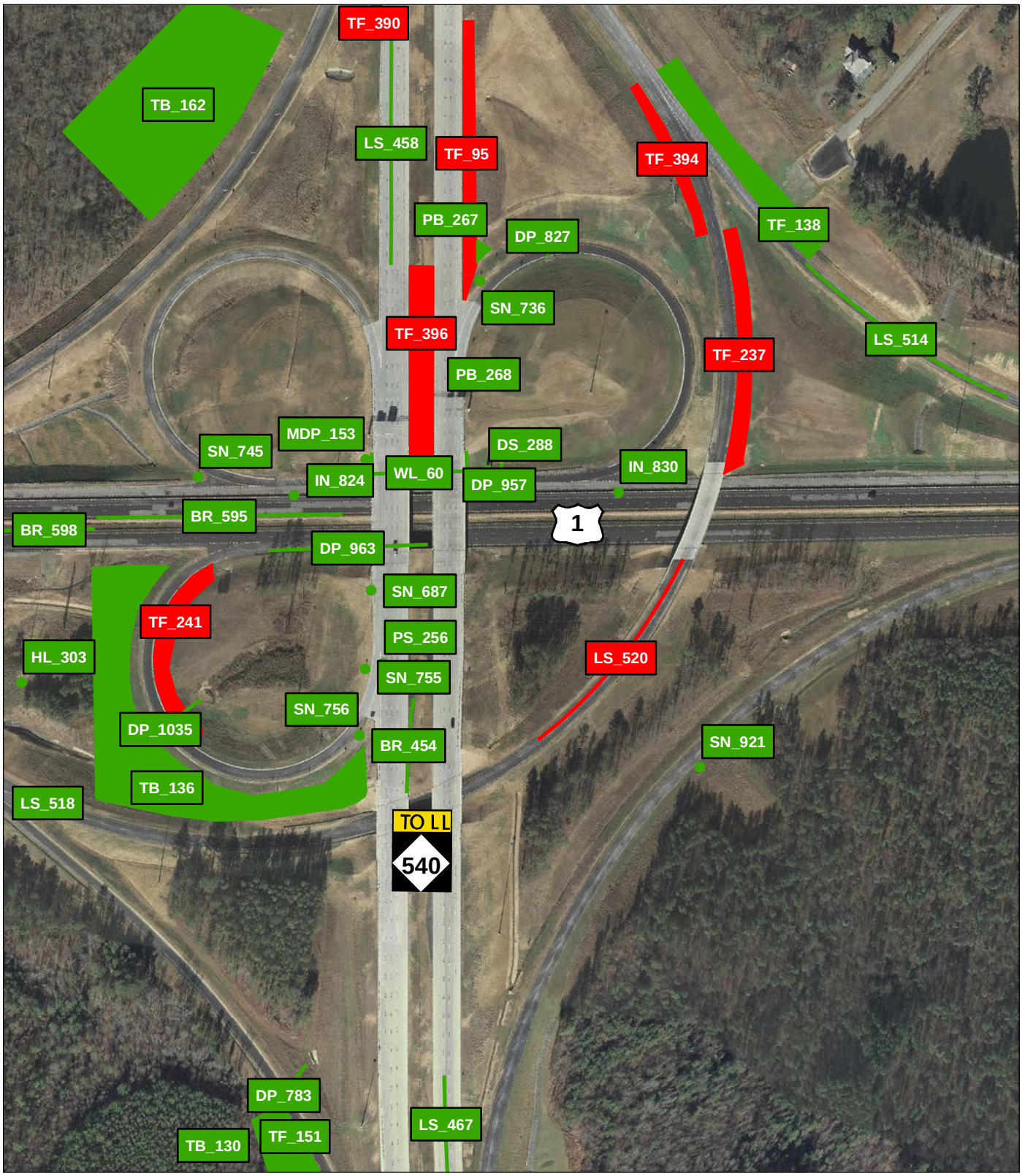

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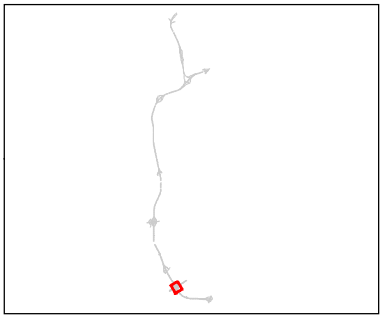

NORTH CAROLINA Turnpike Authority

Appendix A: Triangle Expressway 2014 Fourth Quarter Asset Assessment Locations

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NORTH CAROLINA Turnpike Authority

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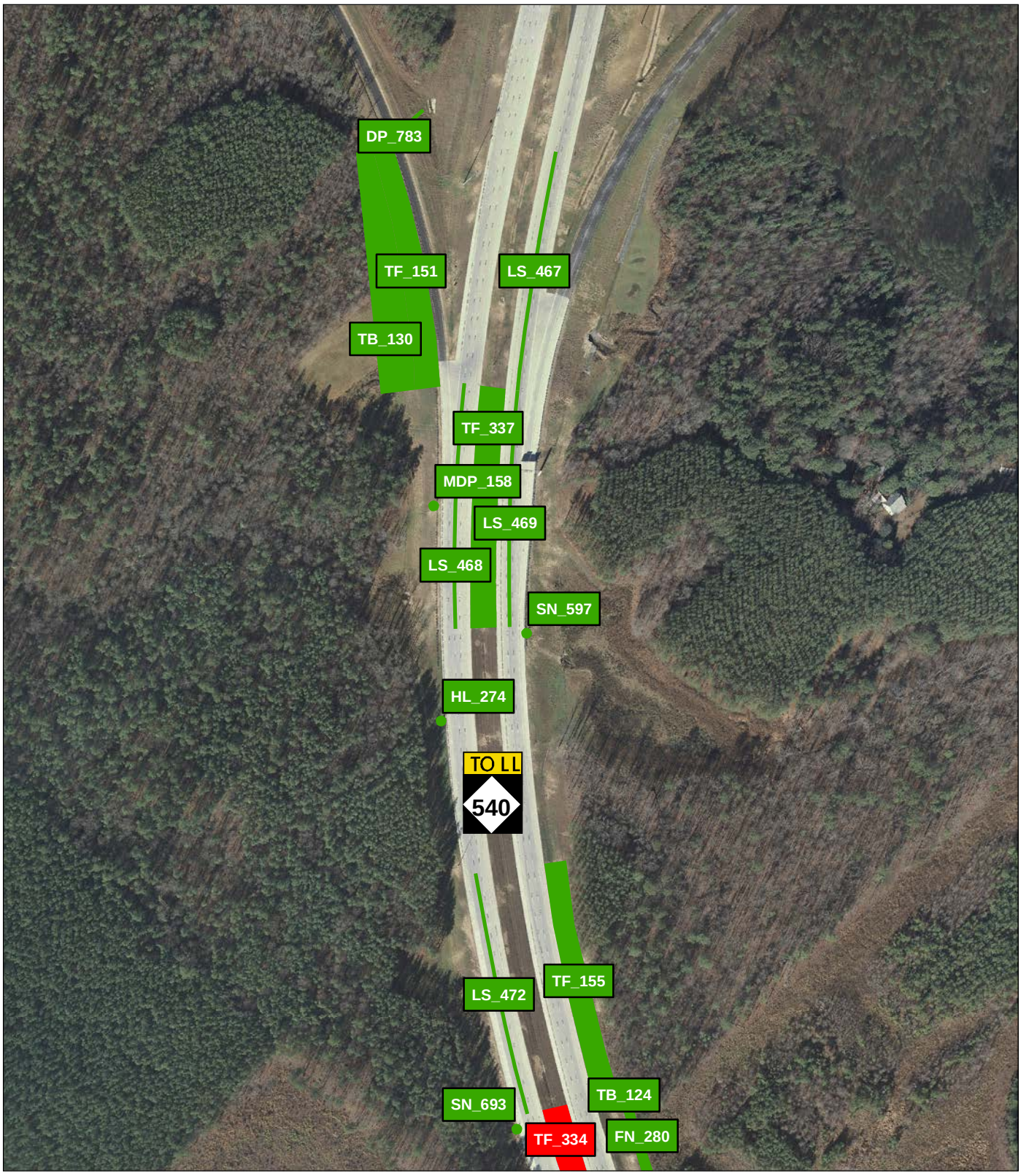

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NORTH CAROLINA Turnpike Authority

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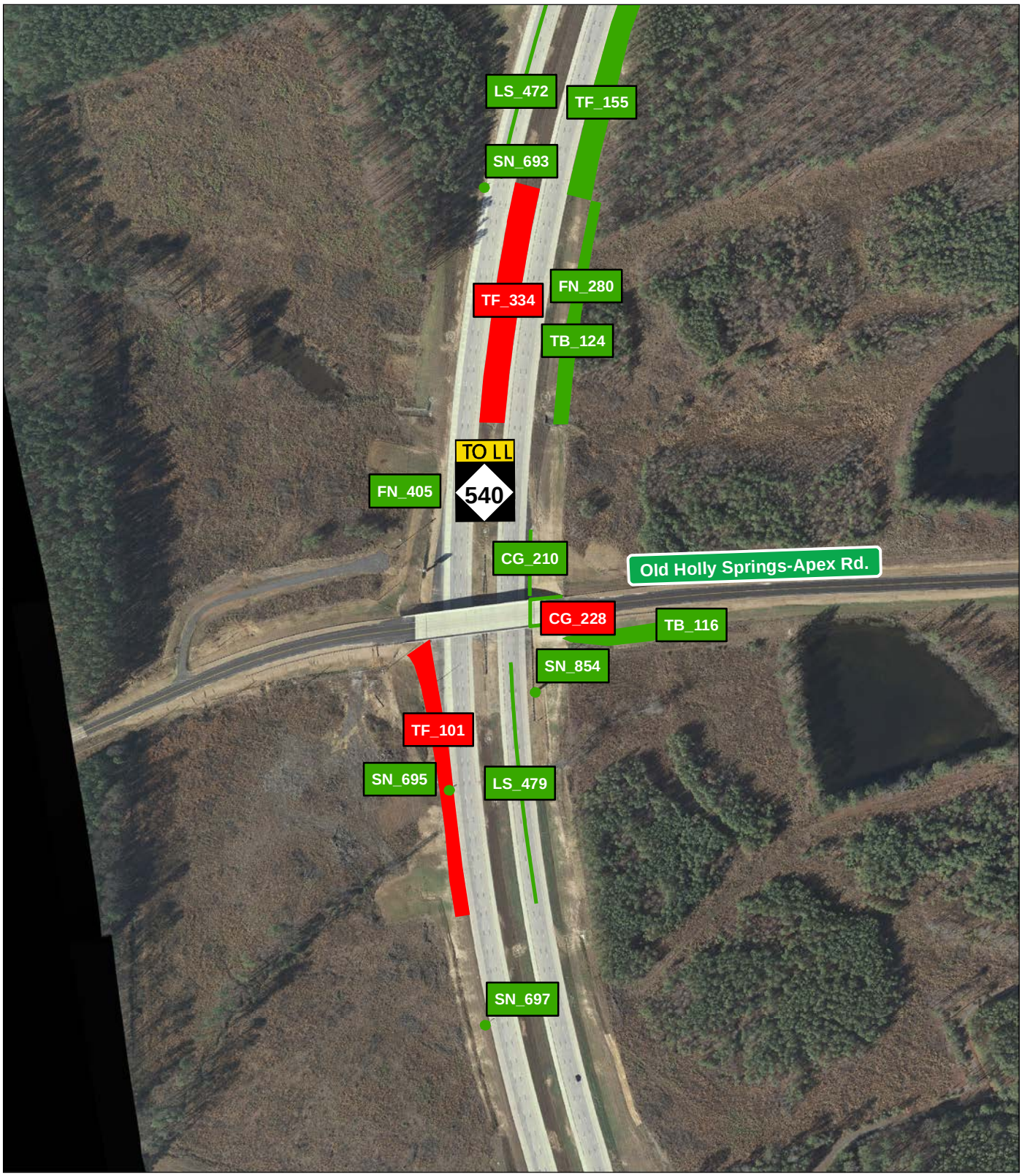

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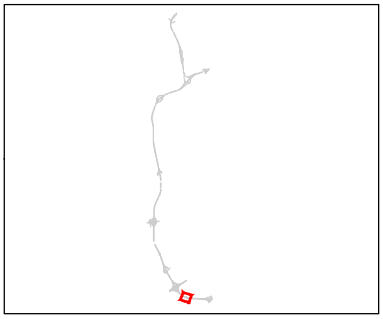

NORTH CAROLINA Turnpike Authority

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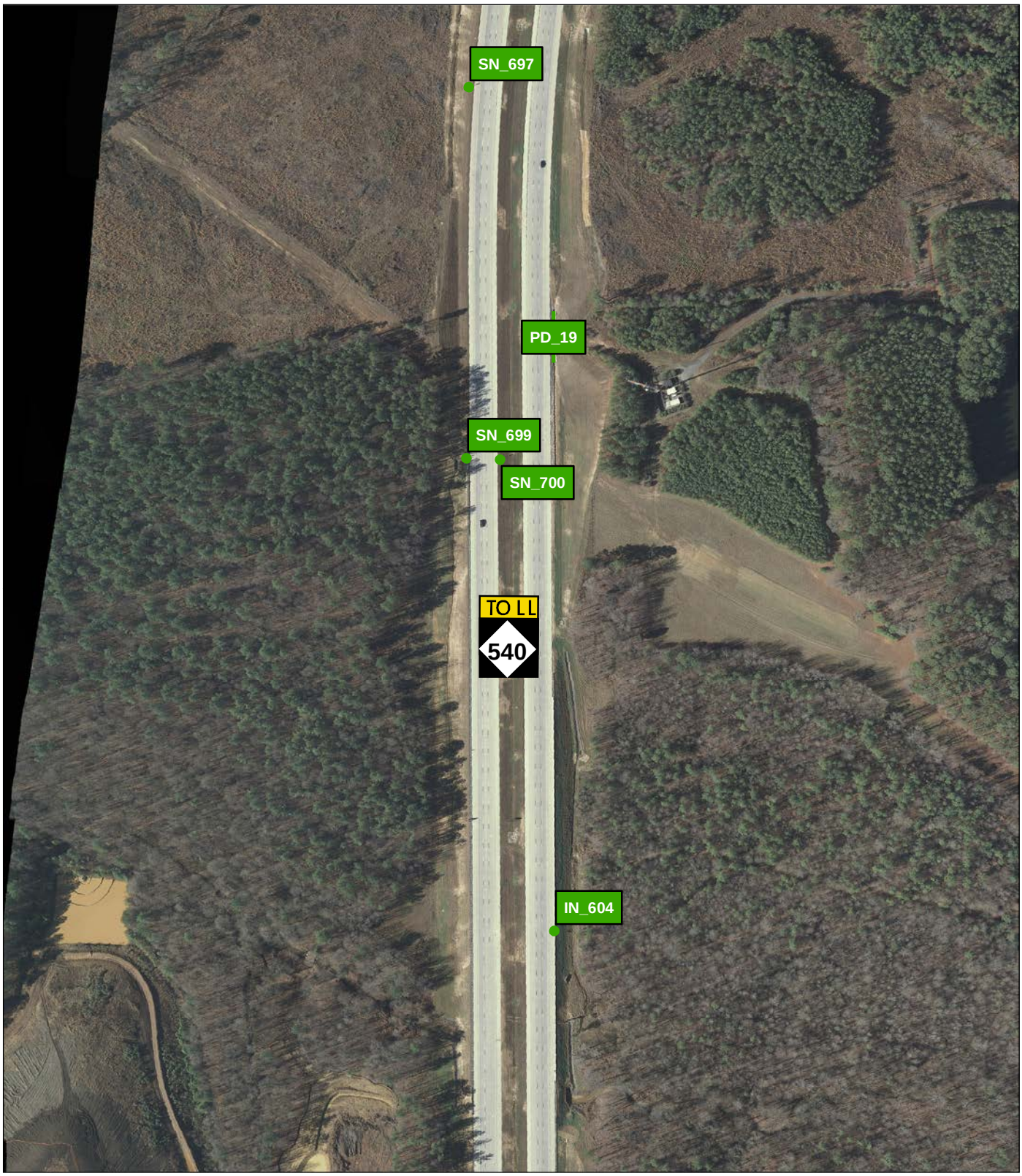

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NORTH CAROLINA Turnpike Authority

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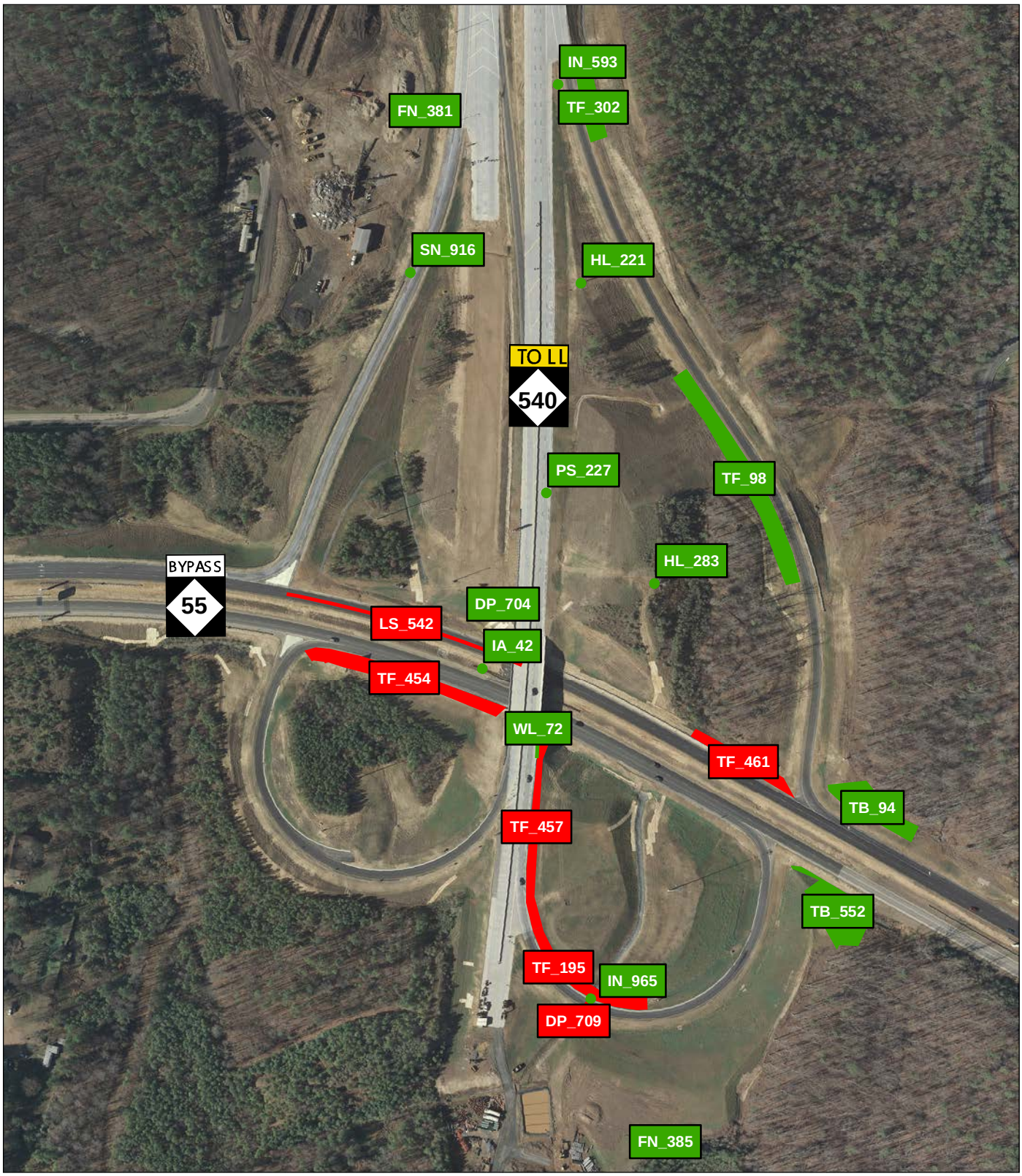

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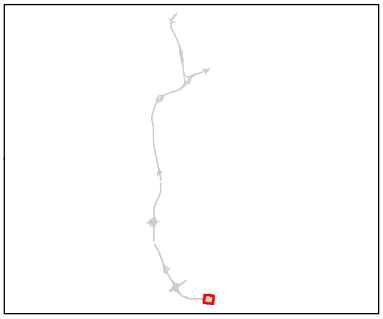

NORTH CAROLINA Turnpike Authority

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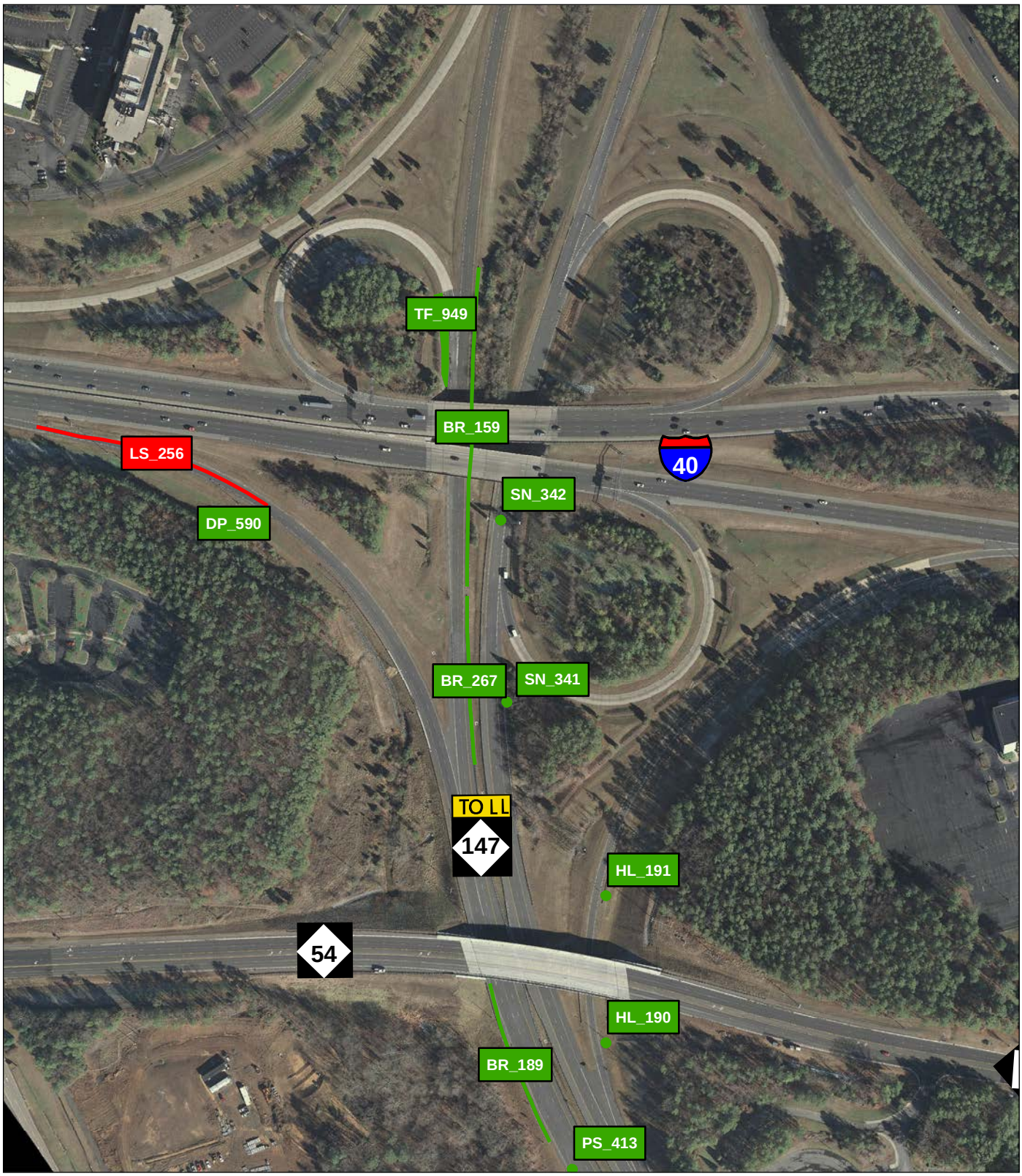

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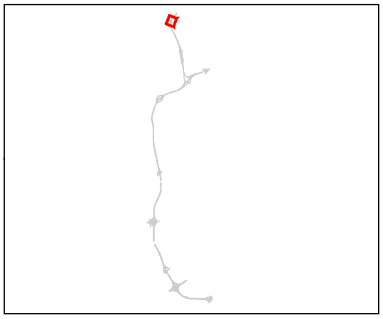

NORTH CAROLINA Turnpike Authority

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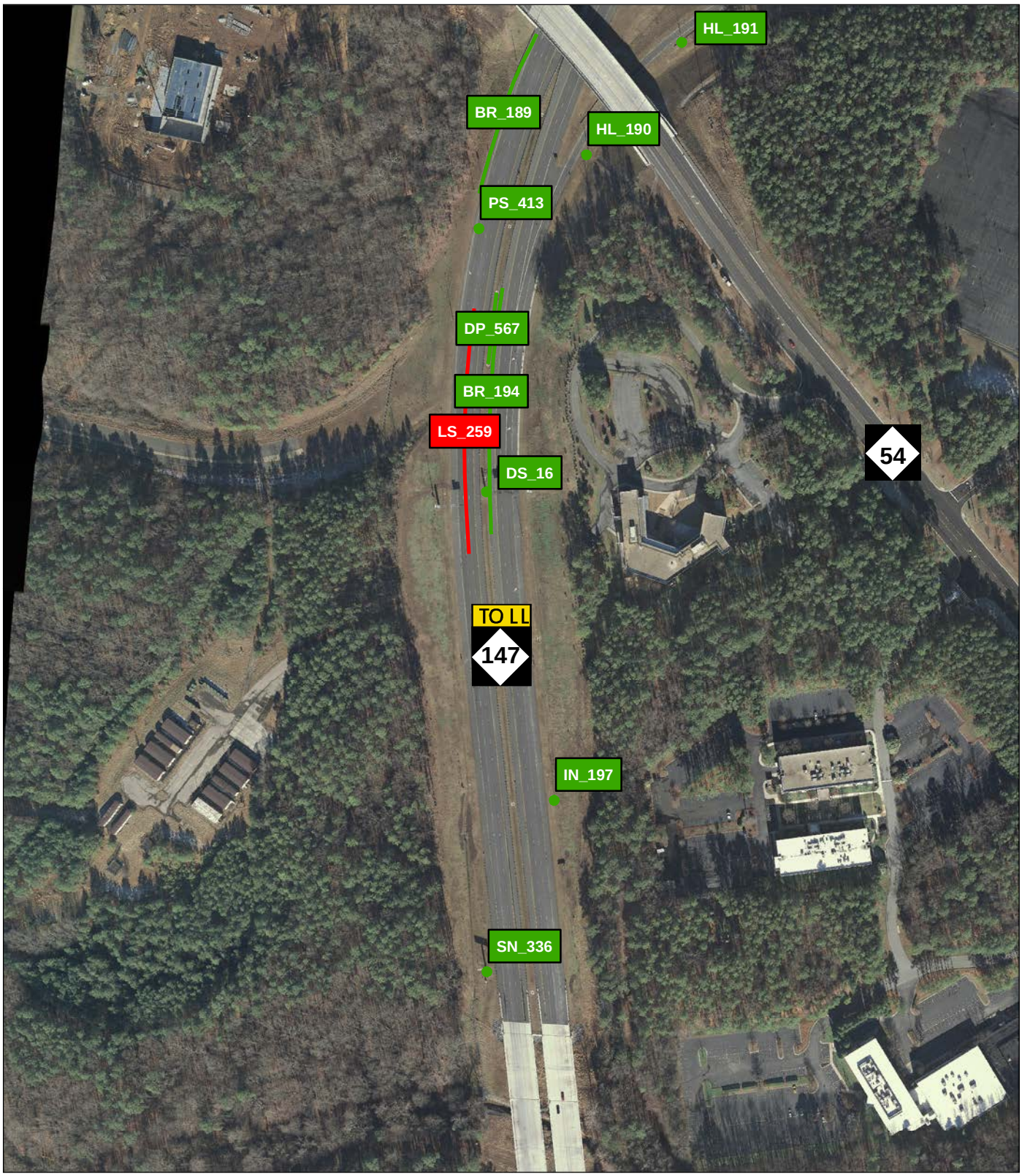

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NORTH CAROLINA Turnpike Authority

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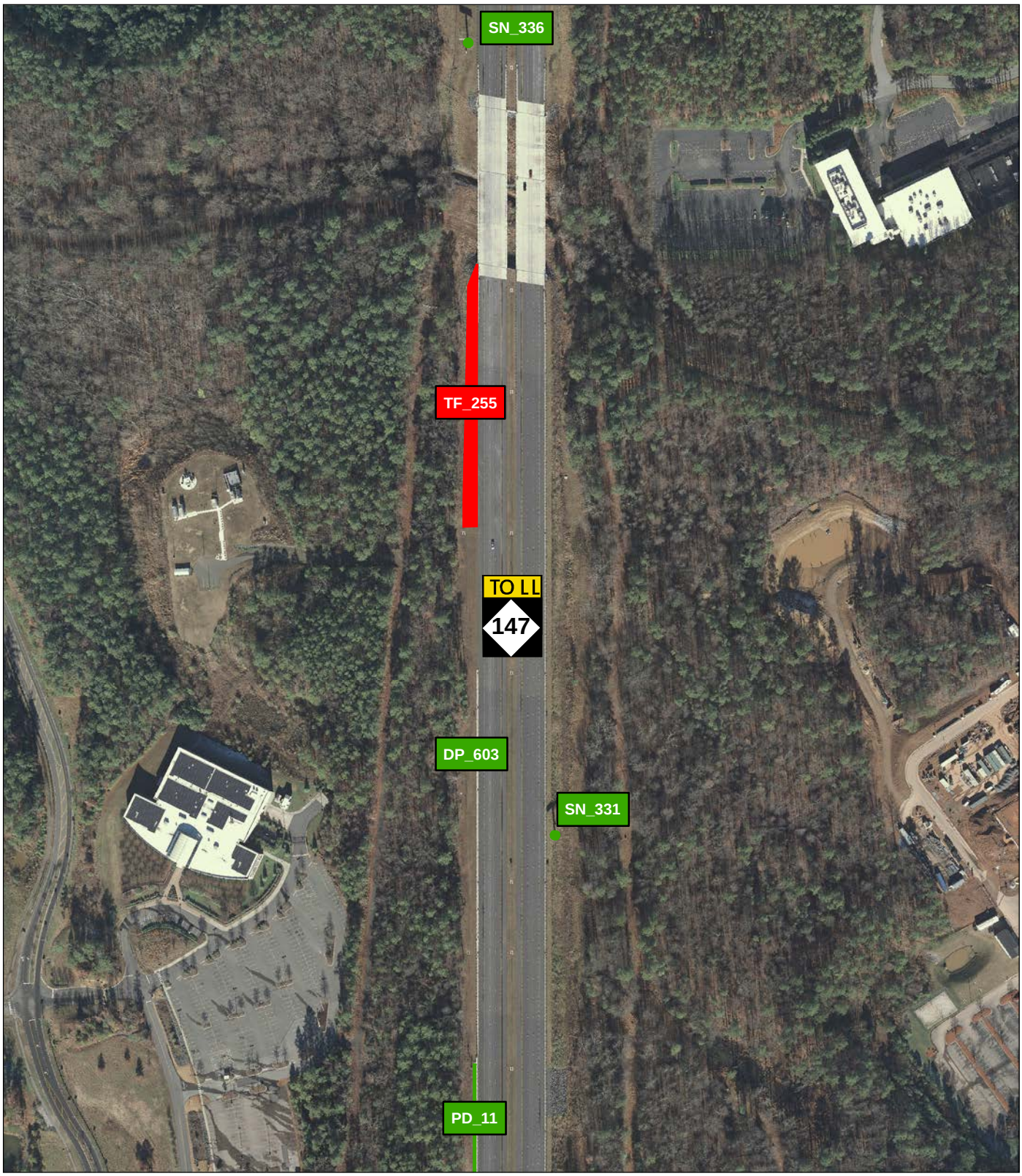

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NORTH CAROLINA Turnpike Authority

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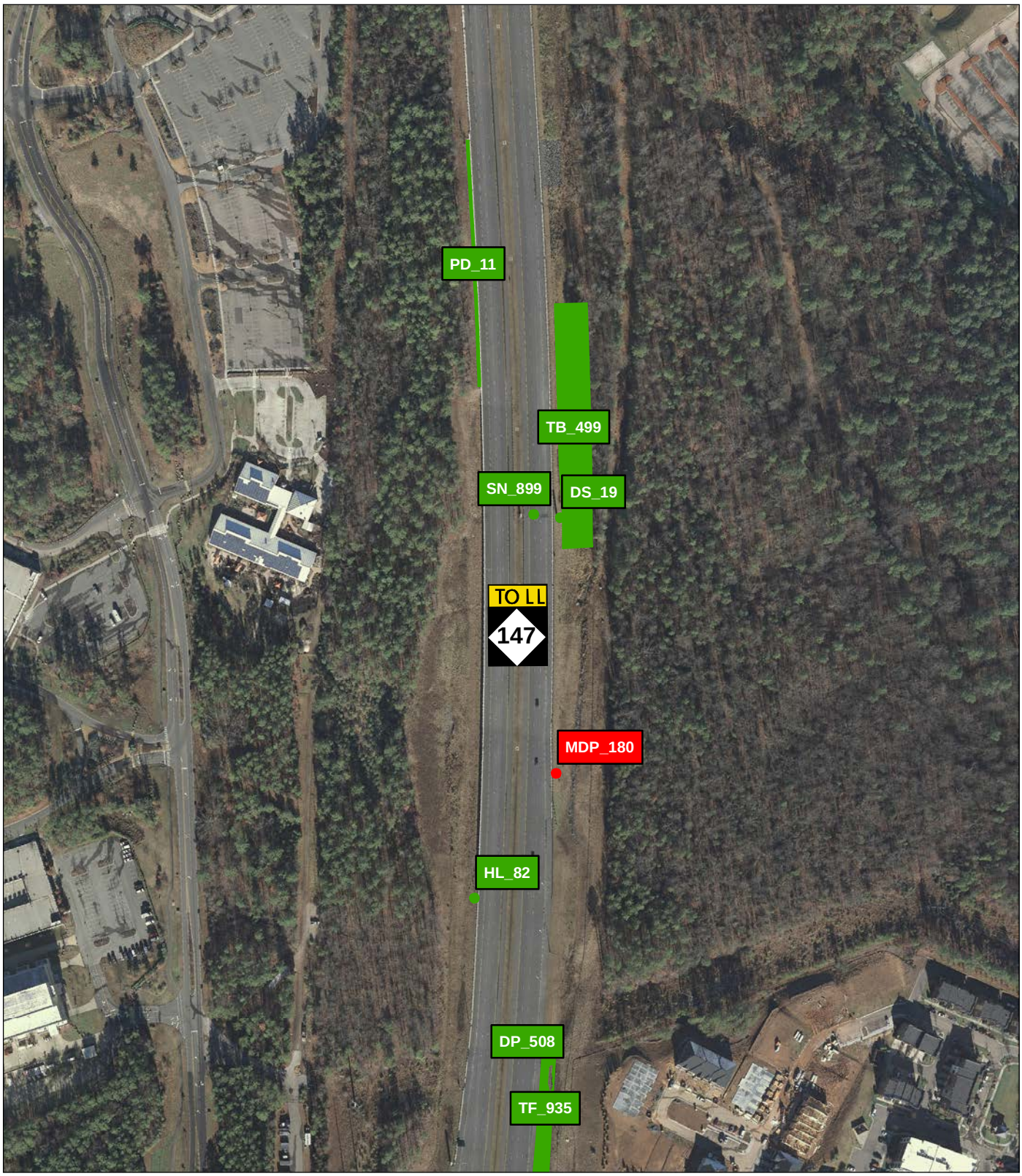

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NORTH CAROLINA Turnpike Authority

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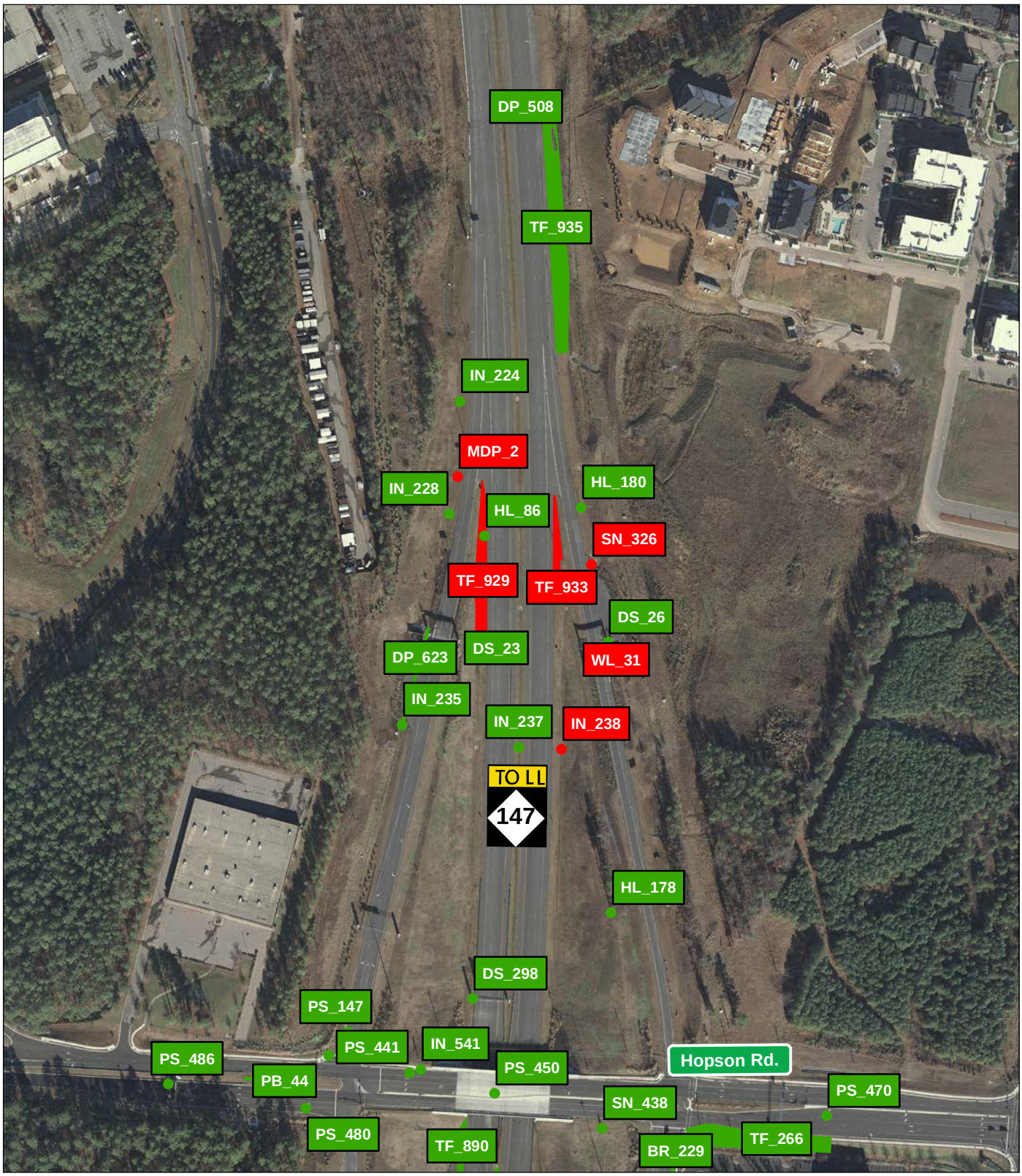

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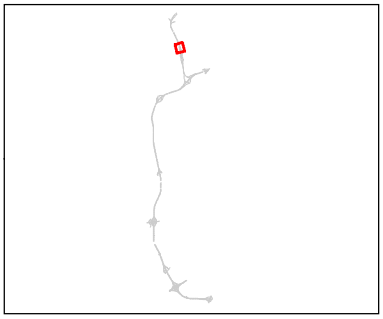

NORTH CAROLINA Turnpike Authority

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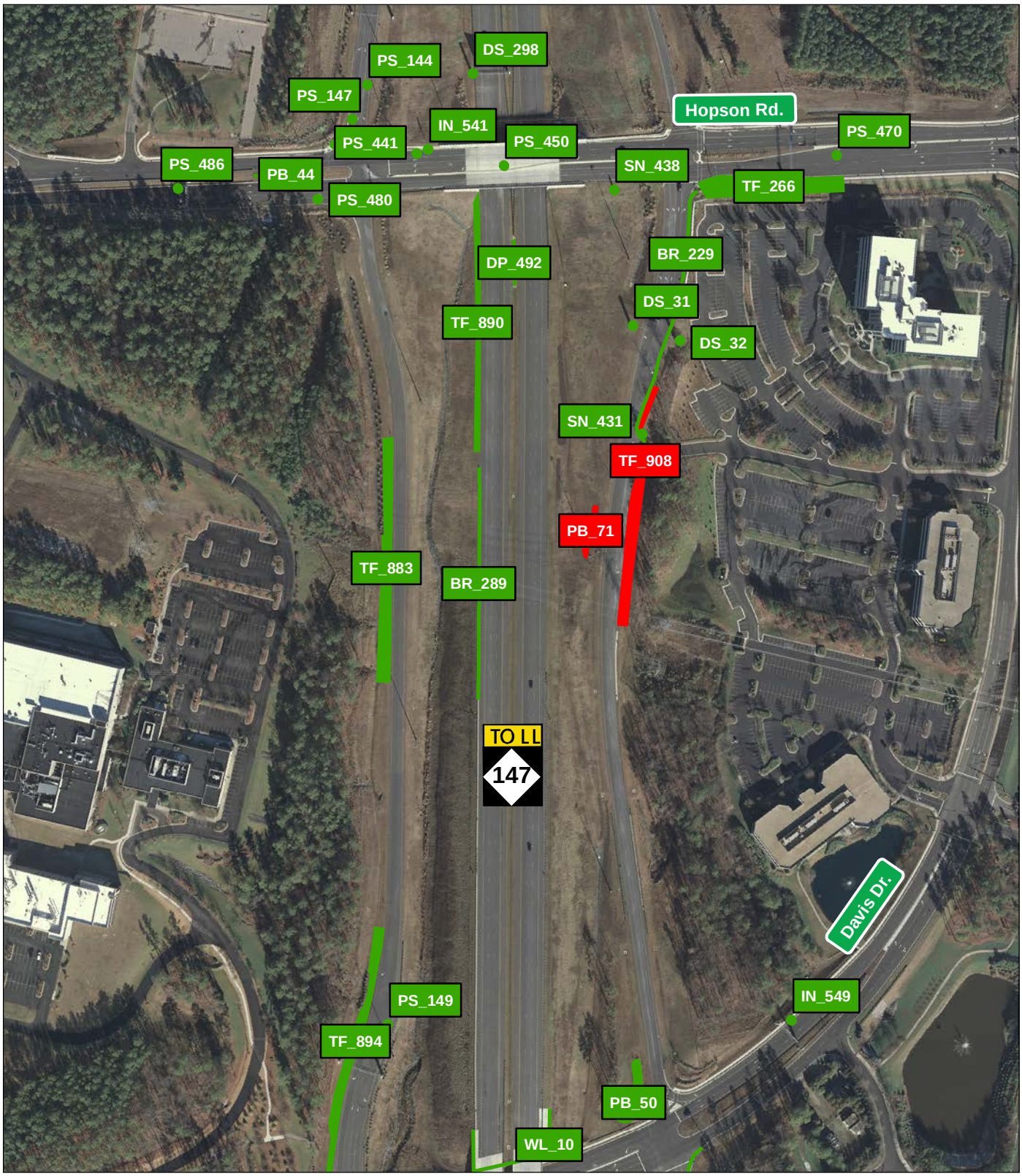

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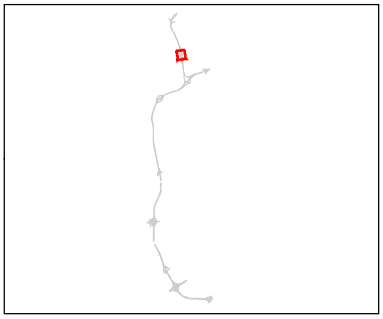
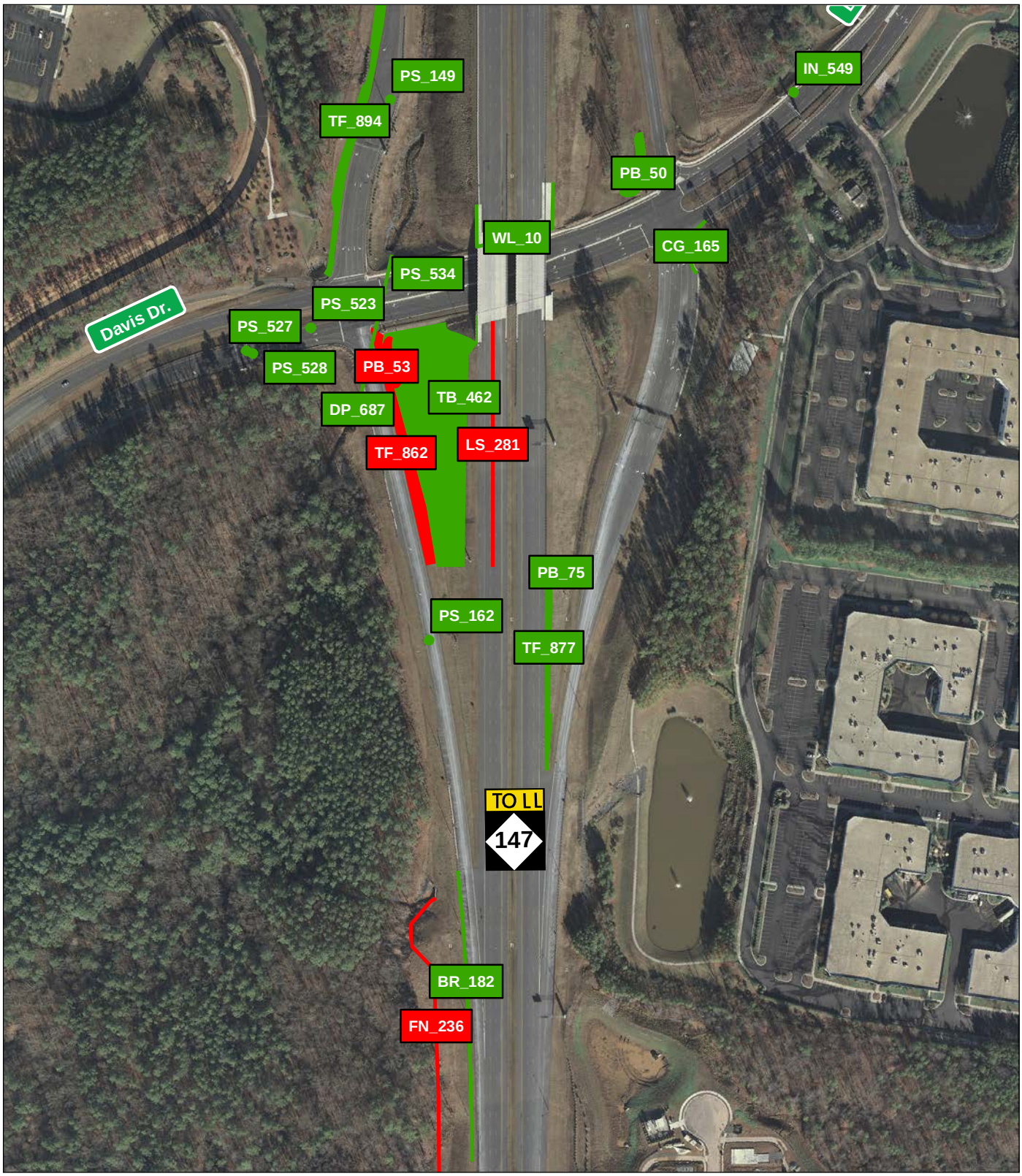


NORTH CAROLINA Turnpike Authority

A53

Appendix A: Triangle Expressway 2014 Fourth Quarter Asset Assessment Locations



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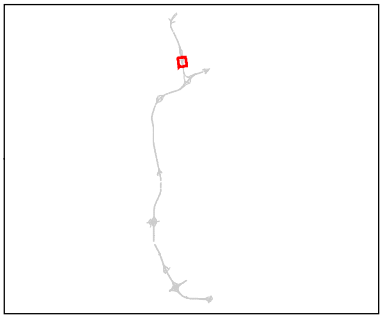

NORTH CAROLINA Turnpike Authority

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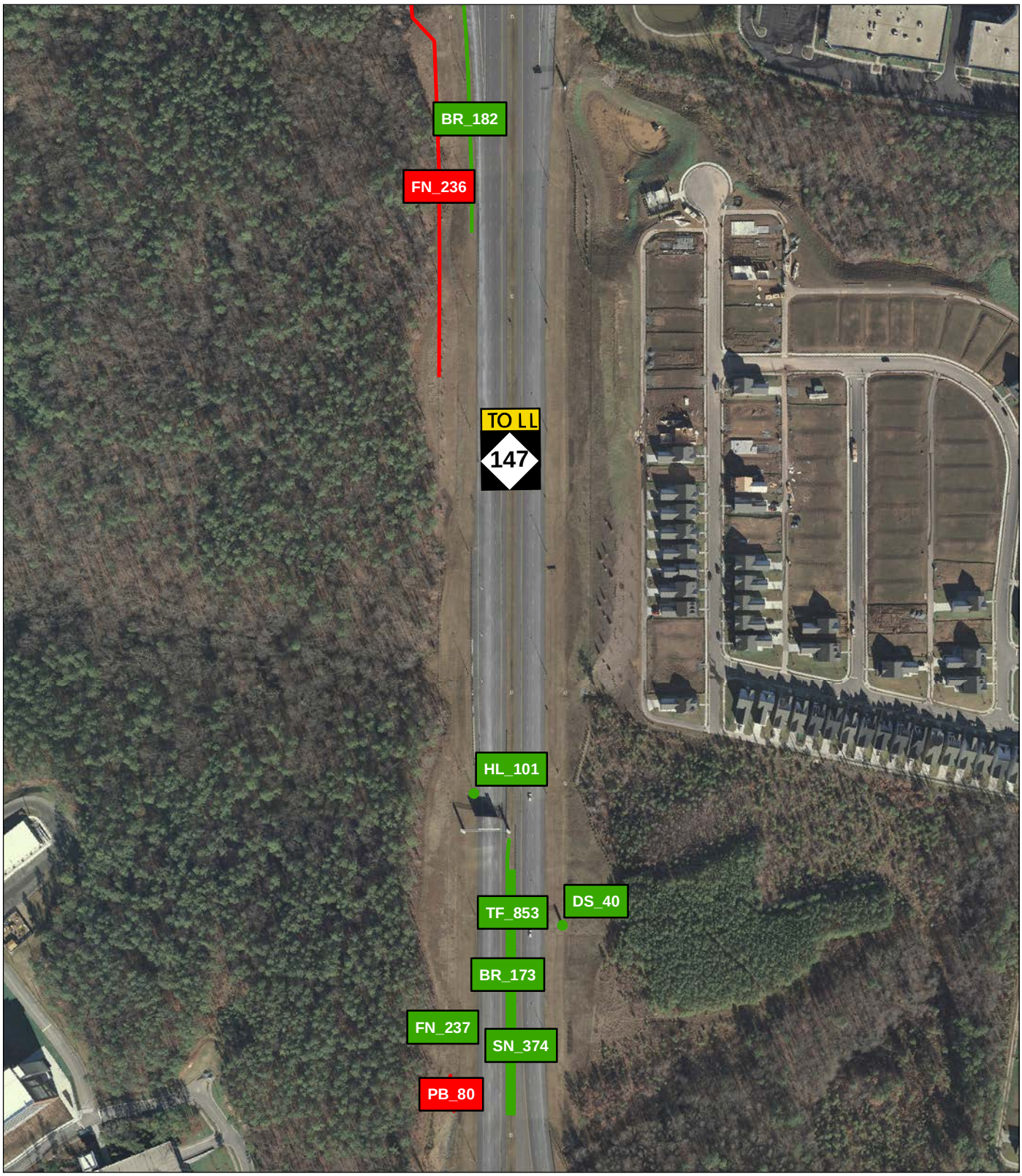

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Passing Asset

Failing Asset

NORTH CAROLINA Turnpike Authority

A55

Appendix A: Triangle Expressway 2014 Fourth Quarter Asset Assessment Locations

Legend

Passing Asset

Failing Asset

NORTH CAROLINA Turnpike Authority

Appendix B

Triangle Expressway 2014 Fourth Quarter Table Results of Assets Failing MRP

Appendix B: Triangle Expressway 2014 Fourth Quarter Table Results of Assets Failing MRP

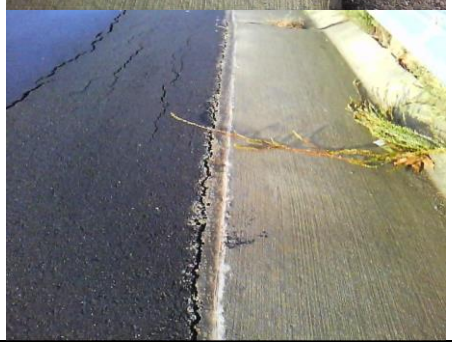
Provided below are a series of tables outlining the existing failures that occurred throughout the facility. Assets are defined by an Inventory ID, which is a unique identifier given to each individual asset. The components that make up the Inventory ID are an asset specific prefix along with a number, such as LS_1. All assets and their respective prefixes are listed below:

The Inventory ID and GIS Reference Page number correspond to the provided map packets and allow for quick location of particular asset failures. Photos of failures were provided when applicable.

Guardrail, Concrete Barrier and End Anchors (BR)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
This asset did not produce any failures.					

Curb and Gutter (CG)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Valley	CG_80	Material Accumulation		A10, A11
2	Concrete	CG_173	Material Accumulation		A46
3	Concrete	CG_228	Settlement and Structural Damage	 	A44

Curb and Gutter (CG)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
4	Valley	CG_251	Material Accumulation		A32

Decorative Supports (DS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Gantry Support	DS_222	Spalling		A46

Drainage Pipes (DP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Cross Pipe	DP_709	Erosion		A47

Miscellaneous Drainage Structures (MDP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Shoulder Drain	MDP_2	Obstruction		A52
2	Shoulder Drain	MDP_13	Obstruction		A13
3	Shoulder Drain	MDP_30	Obstruction		A16
4	Shoulder Drain	MDP_38	Obstruction		A18

Miscellaneous Drainage Structures (MDP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Shoulder Drain	MDP_66	Obstruction		A22, A23
6	Shoulder Drain	MDP_68	Erosion		A23
7	Shoulder Drain	MDP_69	Obstruction		A24
8	Shoulder Drain	MDP_71	Obstruction		A24

Miscellaneous Drainage Structures (MDP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
9	Shoulder Drain	MDP_107	Erosion		A32
10	Shoulder Drain	MDP_111	Obstruction		A32
11	Shoulder Drain	MDP_115	Obstruction		A32, A33
12	Shoulder Drain	MDP_120	Erosion		A35

Miscellaneous Drainage Structures (MDP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
13	Shoulder Drain	MDP_130	Erosion		A36
14	Shoulder Drain	MDP_135	Obstruction		A37
15	Shoulder Drain	MDP_147	Obstruction	 	A39

Miscellaneous Drainage Structures (MDP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
16	Shoulder Drain	MDP_149	Erosion		A39
17	Shoulder Drain	MDP_180	Obstruction		A51

Fence and Control of Access (FN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Chain Link	FN_236	Vegetation Compressing Fence		A54, A55

Graffiti (GR)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	N/A	GR_1	Graffiti on Bridge Railing		A27, A28

Highway Lighting (HL)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Single Roadway	HL_229	Functional Damage		A46

Impact Attenuators (IA)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
This asset did not produce any failures.					

Inlets (IN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Inlet	IN_238	Obstruction		A52
2	Inlet	IN_275	Obstruction		A7
3	Inlet	IN_295	Surface Damage		A8, A9
4	Inlet	IN_859	Obstruction		A39

Landscaping (PB)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Plant Bed	PB_53	Unhealthy		A54
2	Plant Bed	PB_71	Unhealthy		A53
3	Plant Bed	PB_80	Unhealthy		A55, A56
4	Plant Bed	PB_117	Unhealthy		A25

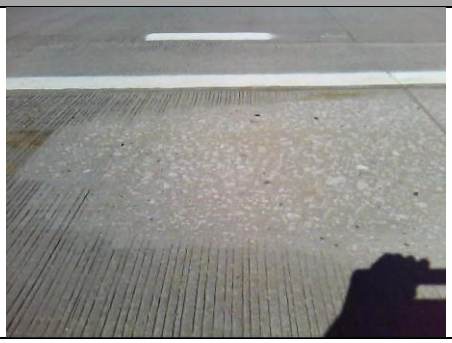
Landscaping (PB)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Plant Bed	PB_167	Unhealthy		A18

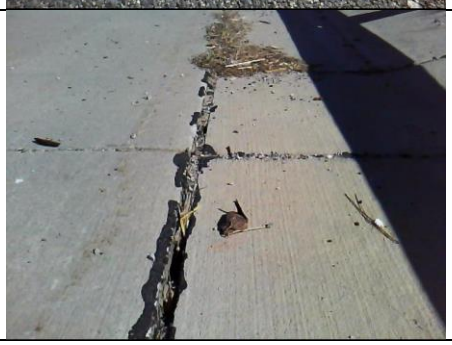
Paved Lanes – Asphalt (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
This asset did not produce any failures.					

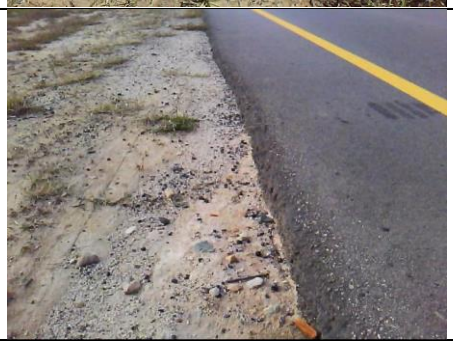
Paved Lanes – Concrete (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_308	Spalling		A4

Paved Shoulders (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_129	Paved Shoulder Joint		A20, A21
2	Asphalt	LS_281	Paved Shoulder Joint		A54
3	Concrete	LS_325	Paved Shoulder Settlement		A6
4	Concrete	LS_340	Paved Shoulder Joint		A8, A9

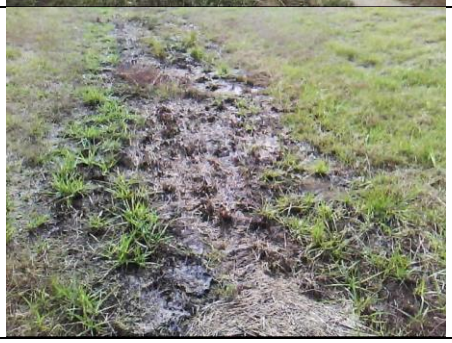
Unpaved Shoulders (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Unpaved Shoulder	LS_209	Shoulder Dropoff		A56
2	Unpaved Shoulder	LS_542	Shoulder Dropoff		A47

Front/Back Slopes (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Slope	LS_364	Slope Failure		A39

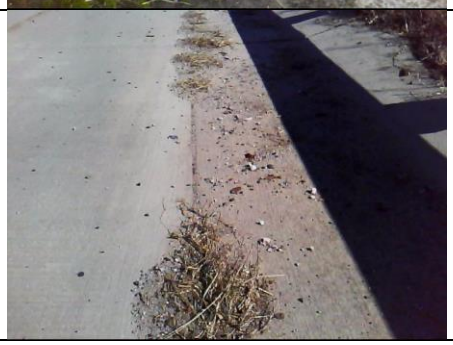
Unpaved Lateral and Outfall Ditches (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Unpaved Lateral Ditch	LS_542	Erosion		A47
2	Unpaved Lateral Ditch	LS_603	Erosion		A33, A34

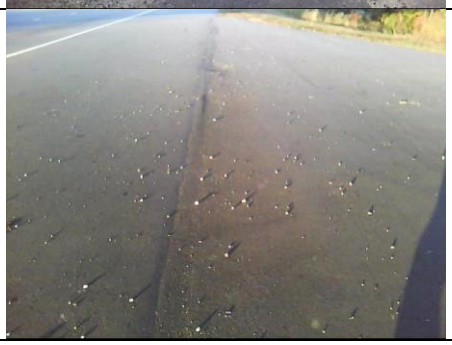
Litter (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
This asset did not produce any failures.					

Roadway Sweeping (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_53	Travelway Sweeping		A17, A18
2	Asphalt	LS_302	Travelway Sweeping		A2
3	Concrete	LS_325	Travelway Sweeping		A6
4	Concrete	LS_340	Travelway Sweeping		A8, A9

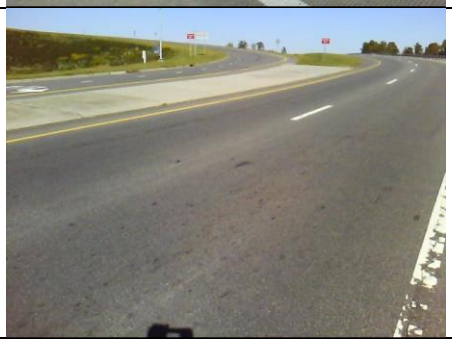
Roadway Sweeping (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Asphalt	LS_542	Travelway Sweeping		A47
6	Asphalt	LS_586	Travelway Sweeping		A29

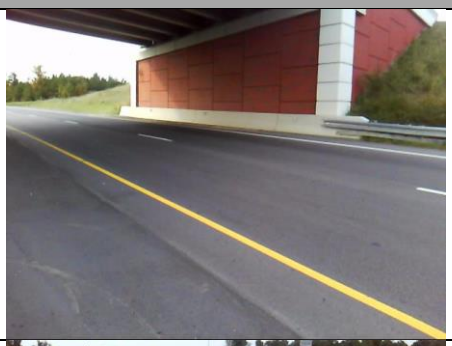
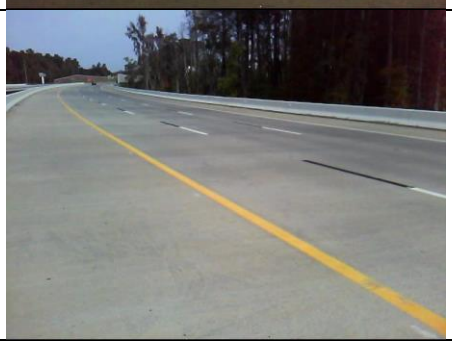
Pavement Striping (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	LS_53	Nightime Line Visibility	Not Available for Nighttime Failure.	A17, A18
2	Concrete	LS_78	Nightime Line Visibility	Not Available for Nighttime Failure.	A24, A 25
3	Concrete	LS_79	Nightime Line Visibility	Not Available for Nighttime Failure.	A25
4	Concrete	LS_129	Nightime Line Visibility	Not Available for Nighttime Failure.	A20, A21
5	Concrete	LS_154	Nightime Line Visibility	Not Available for Nighttime Failure.	A28
6	Asphalt	LS_302	Nightime Line Visibility	Not Available for Nighttime Failure.	A2
7	Asphalt	LS_305	Nightime Line Visibility	Not Available for Nighttime Failure.	A2
8	Concrete	LS_308	Nightime Line Visibility	Not Available for Nighttime Failure.	A4
9	Concrete	LS_325	Nightime Line Visibility	Not Available for Nighttime Failure.	A6
10	Concrete	LS_340	Nightime Line Visibility	Not Available for Nighttime Failure.	A8, A9

Pavement Markers (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_209	Reflective Markers	Not Available for Nighttime Failure.	A56
2	Asphalt	LS_256	Reflective Markers	Not Available for Nighttime Failure.	A48
3	Asphalt	LS_259	Reflective Markers	Not Available for Nighttime Failure.	A49
4	Asphalt	LS_281	Reflective Markers and Missing Markers		A54
5	Asphalt	LS_302	Missing Markers and Continuous Marker		A2
6	Asphalt	LS_305	Reflective Markers	Not Available for Nighttime Failure.	A2
7	Concrete	LS_308	Reflective Markers	Not Available for Nighttime Failure.	A4
8	Concrete	LS_325	Reflective Markers	Not Available for Nighttime Failure.	A6
9	Concrete	LS_340	Reflective Markers	Not Available for Nighttime Failure.	A8, A9
10	Asphalt	LS_520	Missing Markers and Continuous Marker		A41

Pavement Markers (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
11	Asphalt	LS_542	Missing Markers and Continuous Marker		A47
12	Asphalt	LS_572	Missing Markers and Continuous Marker		A37, A38
13	Asphalt	LS_586	Missing Markers		A29
14	Concrete	LS_604	Missing Markers and Continuous Marker		A32, A33

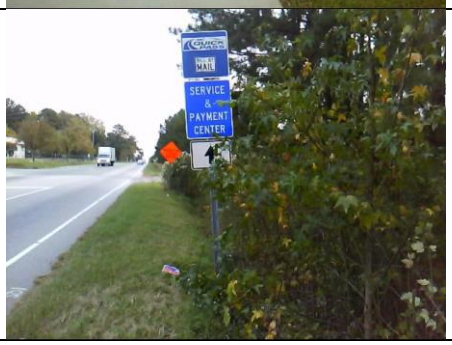
Paved Ditches (PD)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
This asset did not produce any failures.					

Pavement Words and Symbols (PS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Stop Bar	PS_626	Daytime Symbol Visibility		A2

Signs (SN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Authorized Vehicles	SN_326	Height Requirement		A52
2	Speed Limit Exit	SN_379	Missing Parts		A6
3	Mile Post	SN_637	Lateral Clearance		A35
4	Toll Other	SN_1002	Leaning		A3

Tree and Brush (TB)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
This asset did not produce any failures.					

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Turf	TF_28	Bareground		A22
2	Turf	TF_36	Bareground		A15, A16
3	Turf	TF_41	Bareground		A21
4	Turf	TF_95	Bareground		A39, A41

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
5	Turf	TF_101	Bareground		A44
6	Turf	TF_195	Bareground		A47
7	Turf	TF_205	Bareground		A30
8	Turf	TF_207	Bareground		A28, A29, A30

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
9	Turf	TF_209	Bareground		A28, A29, A30
10	Turf	TF_237	Bareground		A39, A41
11	Turf	TF_241	Bareground		A40, A41
12	Turf	TF_255	Bareground		A50

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
13	Turf	TF_334	Bareground		A43, A44
14	Turf	TF_390	Bareground		A39, A41
15	Turf	TF_394	Bareground		A39, A41
16	Turf	TF_396	Bareground		A41

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
17	Turf	TF_452	Bareground		A34
18	Turf	TF_454	Bareground		A47
19	Turf	TF_457	Bareground		A47
20	Turf	TF_461	Bareground		A47

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
21	Turf	TF_501	Bareground		A31
22	Turf	TF_504	Bareground		A29, A30, A31
23	Turf	TF_612	Bareground		A18, A19
24	Turf	TF_614	Bareground		A18, A19

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
25	Turf	TF_675	Bareground		A12
26	Turf	TF_696	Bareground		A12
27	Turf	TF_791	Bareground		A5
28	Turf	TF_862	Bareground		A54

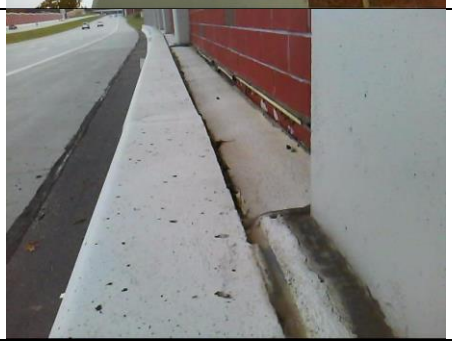
Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
29	Turf	TF_908	Bareground		A53
30	Turf	TF_929	Bareground		A52
31	Turf	TF_933	Bareground		A52
32	Turf	TF_1003	Bareground		A11, A12

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
33	Turf	TF_1009	Bareground		A9, A10, A11

MSE/Retaining Walls, Sound Barrier Walls and Screen Walls (WL)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Screen Wall	WL_31	Spalling		A52
2	Sound Wall	WL_95	Cracked Joint		A33, A34